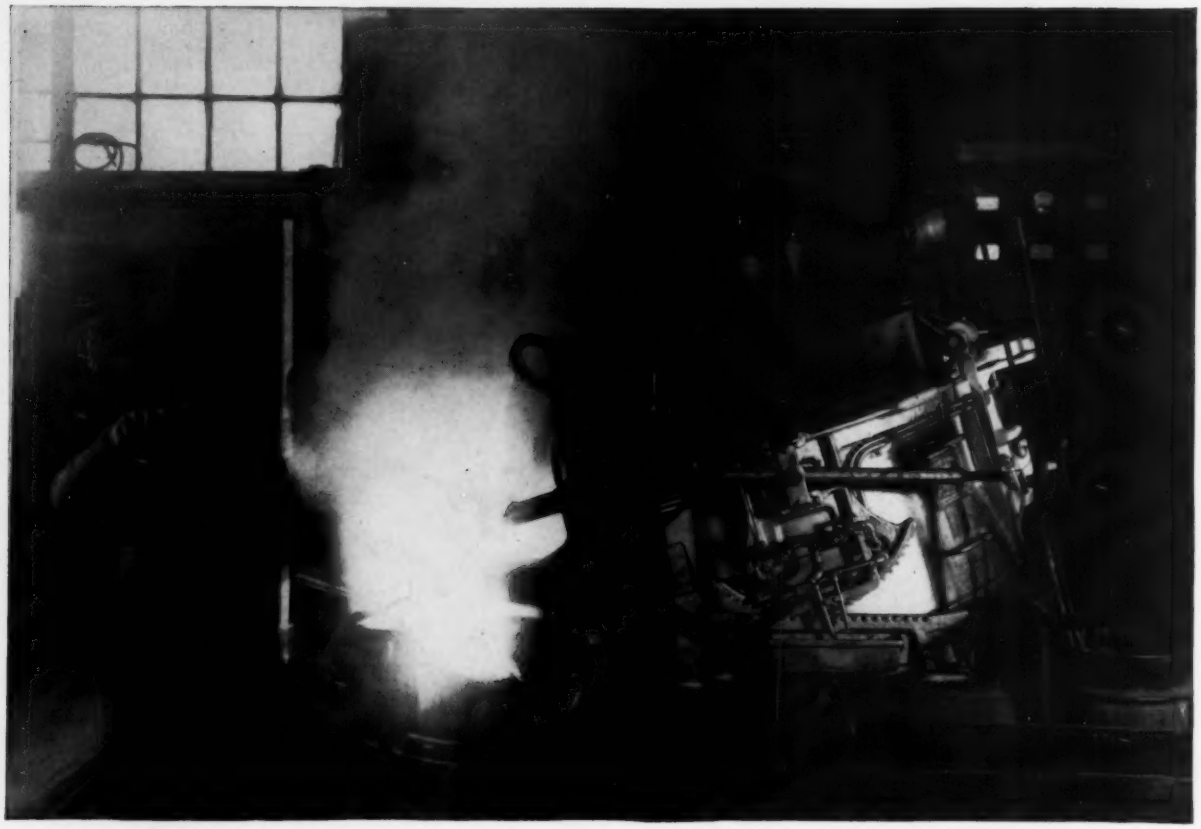
American Foundryman

The Foundrymen's Own Magazine

PRE-CONVENTION *Issue* MAY NINETEEN HUNDRED AND FIFTY FOUR



Duplexing in this Lectromelt Furnace gives castings specified wear, heat and pressure resistance.

"Specials are routine . . . with our *Lectromelt** Furnace"

"Special irons for special castings are routine production in our plant," says one gray iron foundry plant engineer. "The electric furnace process is the only way to produce irons that will meet the tensile strength and machinability requirements that our customers need in special castings," his chief metallurgist added.

The furnace being talked about was a Lectromelt. And the results are typical of the precise control Lectromelt Furnaces make possible. Whether you're working with irons, semi-steels or alloy steels, a Lectromelt Furnace will give you precise control at costs often comparable to cupola melting . . . yet, with unmatched flexibility.

Laborsaving, top-charging Lectromelt Furnaces provide such control at low cost whether for melting, smelting, refining or reduction. Our engineers will gladly discuss means of cutting costs for these operations without cutting quality. Write, Pittsburgh Lectromelt Furnace Corporation, 316 32nd Street, Pittsburgh 30, Pa.

Manufactured in . . . ENGLAND: Birlec, Ltd., Birmingham . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa. JAPAN: Daido Steel Co., Ltd., Nagoya

*REG. T. M. U. S. PAT. OFF.

MOORE RAPID

WHEN YOU MELT... *Lectromelt*

ATTENTION

"GOOD HOUSEKEEPERS"

DUSTLESS SEACOAL

AND PITCH BINDERS

Ask your FEDERAL representative to demonstrate the new "dustless" additives. He'll use two jars of seacoal—one containing "regular" seacoal, the other "dustless" seacoal. When shaken vigorously, and the cap removed, the jar of "regular" gives off clouds of dust. But, *no dust* arises from the jar of "dustless", when it is subjected to the same agitation.

FEDERAL now offers "DUSTLESS" seacoal and pitch binders as a contribution to the movement toward "better housekeeping" in foundries. Chemically treated to minimize dustiness in handling, these sand additives will help provide more healthful working conditions—by substantially reducing skin irritation and dust inhalation. There's economy in FEDERAL "dustless" products, too, despite a slightly higher cost. In addition to the benefits from "better housekeeping", their use holds to an absolute minimum the usual dust-losses in air-swept mixing and handling equipment.

FEDERAL's "dustless" treatment does *not* involve the addition of "wetting agents" that can have detrimental effects on sand mixtures. FEDERAL's is a *chemical* treatment that in no way affects the performance of sand additives.

FEDERAL will continue to stock "regular" seacoal and pitch binders, along with the "dustless" type. But, we strongly urge you to switch to, or at least investigate, our new "dustless" products.

FEDERAL

Make your foundry a better place in which to work!

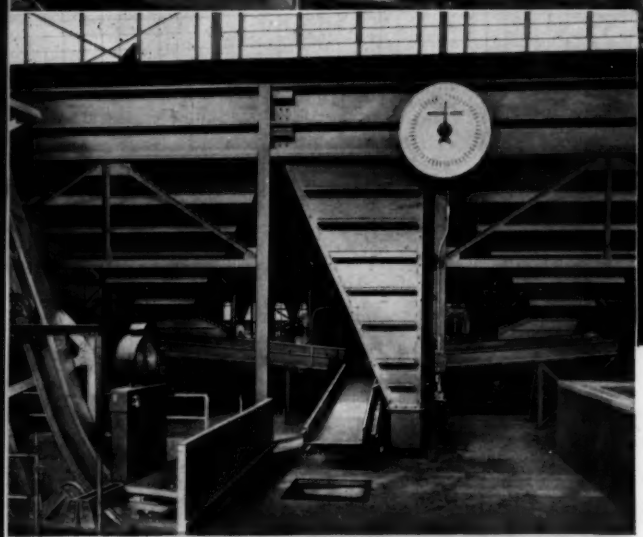
The FEDERAL FOUNDRY SUPPLY *Company*

4600 EAST 71st STREET, CLEVELAND 5, OHIO

CROWN HILL W. VA. • CHICAGO • DETROIT • MILWAUKEE • RICHMOND VA. • ST. LOUIS • CHATTANOOGA • NEW YORK • UPTON WYO.

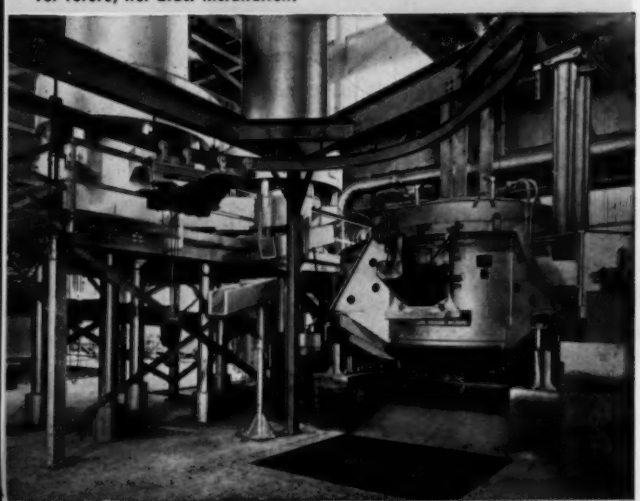
IN TWIN CITIES C. O. Gallaher Company 428 Stinson Blvd. Minneapolis

ANOTHER FIRST SHOWING



Stone and two compartment coke bin with conveyors feeding coke to central, retractable conveyor. Large dial aids the crane operator in preparing accurate charges.

Front view of duplexing operation. Tilting, cupola spout directs metal to either the electric furnace or to a secondary, swiveling spout for filling the ladles. Cupolas are designed for future, hot blast installation.



80 TONS IN 8 HOURS FROM—

- Modern, swivel charger with small-cone, side-discharge bucket serving two cupolas . . .
- Overhead crane and magnet charging metal into weigh hopper . . .
- Coke bins, fitted with retractable conveyor, convey the coke to the weigh hopper . . .
- Two, 78", Modern cupolas with—water type spark arrestors, water slag removal, centrifugal blowers and automatic control equipment . . .
- From cupolas the metal flows through furnace to Modern distributing ladles and on to the pouring floors . . .

This installation — synchronized for high tonnage and low operating cost at Fairbanks, Morse & Company in Kansas City is showing at Cleveland. Plan to see the colored translites! These and other new, interesting, MODERN DEVELOPMENTS are on display in booths 1112 and 1205, Upper Lakeside Hall . . .

MODERN

MODERN EQUIPMENT COMPANY

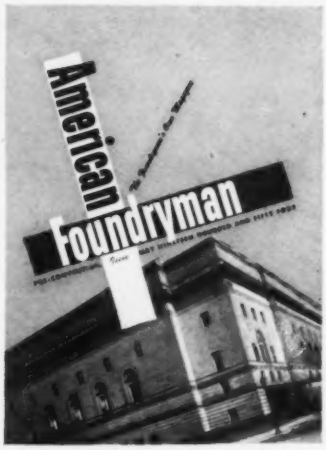
Port Washington, Wisconsin

BOOTHS 1112 AND 1205

American Foundryman

Volume 25 *May 1954* *Number 5*

Published by American Foundrymen's Society



Cleveland will be the focal point of the metals casting industry, May 8-14. The Annual AFS Convention and Foundry Show will be held in the Public Auditorium and will set records for size and number of exhibits and technical activities. Attendance should equal or exceed any previous Convention in the 58-year history of the event.

In This Issue . . .

58th Annual AFS Convention 68
Annual Awards 74
Honorary Life Membership 75
List of Exhibitors 76
Convention Program 78
AFS Officers and Directors 92
Ladies Program 94
Convention Host Committees 96
Plant Visitations 99
Heat Treating Department 102
R. W. Wilson
Producing Titanium Castings 107
Marvin Glassenberg and M. J. Berger
Gating and Risering of Titanium—Part 2 113
H. E. Elliott
Pre-Mixing for Reconditioning 123
Burdette Jones
Melting Borings and Turnings 127
Wm. Y. Buchanan
Developments in Shell Molding 138
E. I. Valyi
Automatic Mold Stacking 144
Greg Minogue
East Coast Regional Conference 149
F.E.F. College-Industry Conference 150
New AFS Headquarters 153
Gray Iron Redesigning 155
Exhibits Preview 176

Departments . . .

Foundrymen in the News 54
Talk of the Industry 67
Future Meetings and Exhibits 137
Foundry Facts 147
News of Technical Committees 152
Foundry Trade News 154
Chapter News 156
Free Foundry Information 188
Casting Through the Ages 214
Chapter Meetings 224
Abstracts 228
Rammed Up and Poured 232
Classified Advertising 233
Advertisers Index 234

A.F.S. Headquarters
616 S. Michigan, Chicago 5

Wm. W. Maloney
Secretary-Treasurer
H. J. Heine
Technical Director

American Foundryman

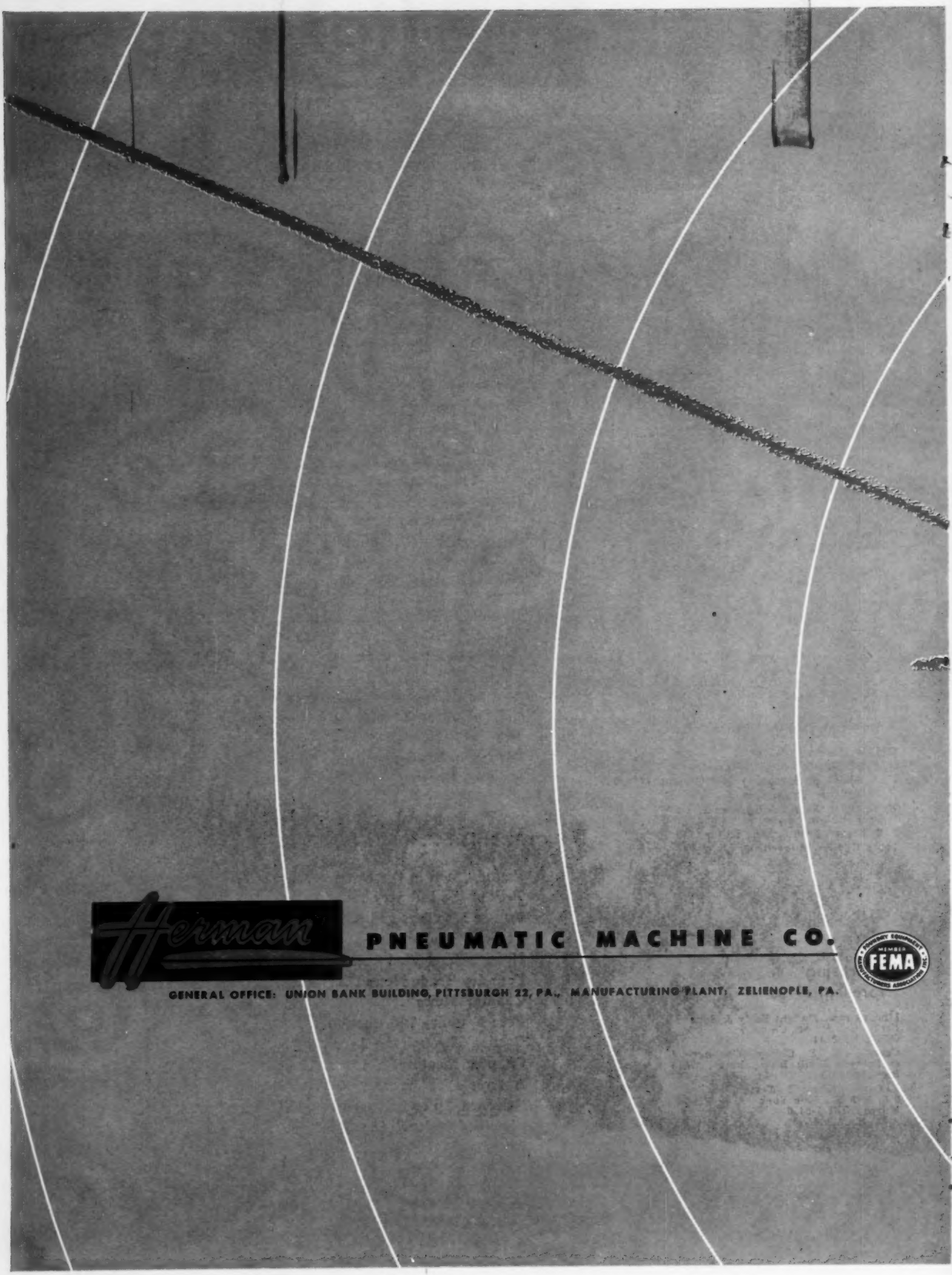
Wm. W. Maloney, *Editor*
H. F. Scobie, *Technical Editor*
H. J. Wheelock, *Managing Editor*
G. J. Minogue, *Production*
W. N. Davis, *Safety & Hygiene & Air Pollution Editor*
J. E. Foster, *Transactions Editor*
Terry Koeller, *Advertising Manager*

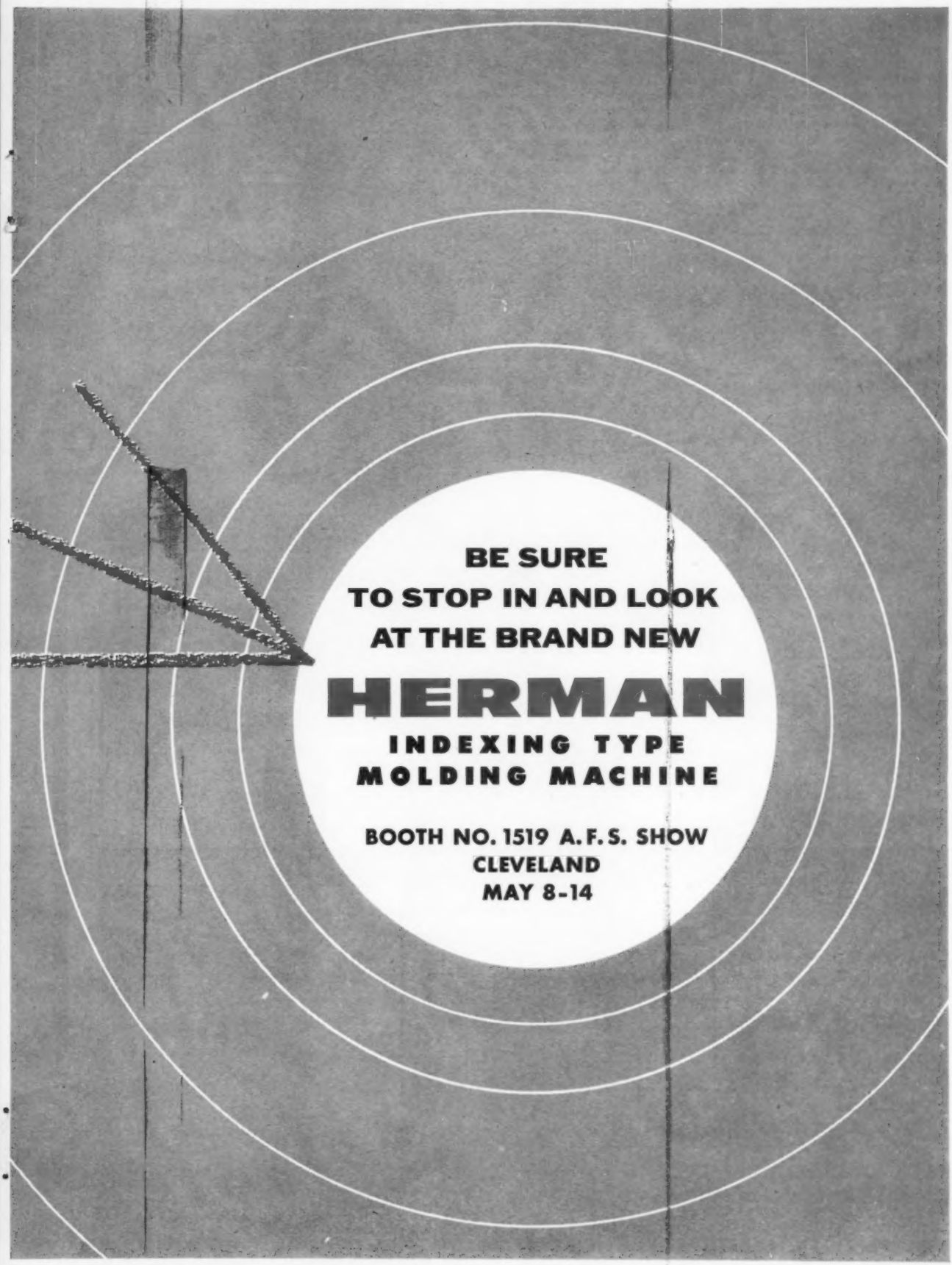
Advertising Representatives

MIDWESTERN—Dwight Early & Sons
100 N. LaSalle St., Chicago
CEntral 6-2184
CENTRAL—R. E. Cleary, *Commercial & Savings Bank Bldg., Berea, Ohio*
Berea 4-.7719
EASTERN—Robert B. Weston,
6 E. 39th St., New York
Murray Hill 5-9450

AUDITED PAID CIRCULATION ABC

Published monthly by the American Foundrymen's Society, Inc., 616 S. Michigan Ave., Chicago 5. Subscription price in the U.S., Canada and Mexico $3.00 per year; elsewhere, $6.00. Single copies 50c. May and June issues $1.00. Entered as Second Class Matter, July 22, 1938, under Act of March 3, 1879, at the Post Office, Chicago.

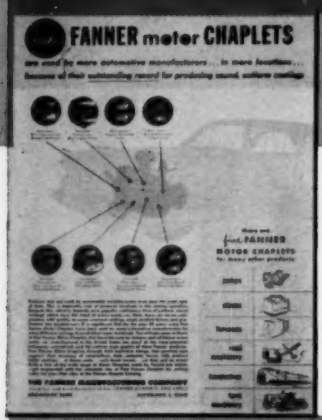

Herman
PNEUMATIC MACHINE CO.
GENERAL OFFICE: UNION BANK BUILDING, PITTSBURGH 22, PA., MANUFACTURING PLANT: ZELIENOPLE, PA.
MEMBER
FEMA


BE SURE
TO STOP IN AND LOOK
AT THE BRAND NEW
HERMAN
INDEXING TYPE
MOLDING MACHINE
BOOTH NO. 1519 A.F.S. SHOW
CLEVELAND
MAY 8-14

fine FANNER products

For years you have been reading about FANNER developments for the improvement of castings, since fine FANNER chaplets and chills have been regarded as the standard in the foundry industry for almost 60 years. Today FANNER is the world's largest manufacturer of chaplets and chills and the only organization making a complete line to meet all needs. Cleveland is our home and while you are attending the AFS Convention we invite you to visit with us and see how and why fine FANNER chaplets and chills do a better job for you at the lowest cost!

ONE BY ONE
YOU SEE
THEIR ADVANTAGES
IN PRINT
every month



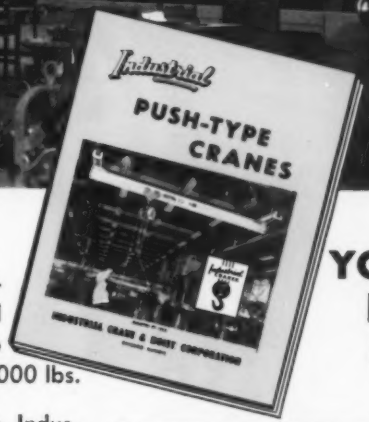
THE FANNER MANUFACTURING CO.
BROOKSIDE PARK **CLEVELAND 9, OHIO**
Designers and Manufacturers of Fine Fanner Chaplets and Chills

Now
see them IN PERSON
Booth No. 1703
AFS Convention • Public Auditorium
CLEVELAND MAY 8-14
Fanner Headquarters: Hotel Hollenden

Industrial PUSH-TYPE CRANES

SOLVE MANY MATERIALS HANDLING PROBLEMS

The Overhead Cranes shown in the above photo are a part of the 250 Industrial Push-Type Cranes installed in this modern plant.



Industrial Push-Type Cranes are available in 3 types—a light duty model in capacities to 4000 lbs.—and two heavy duty models in capacities to 8000 lbs.

Economical, rugged and dependable, Industrial heavy duty Push-Type Cranes are equipped with precision made end trucks for smoothest performance. Designed to function well with either hand operated or electric hoists.

Thousands in use throughout industry.

SEND FOR YOUR COPY OF INDUSTRIAL PUSH-TYPE CRANES

INDUSTRIAL CRANE & HOIST CORPORATION
305 NORTH ADA STREET
CHICAGO 7, ILL.

Send copy of Push-Type Crane Bulletin No. PT-1253.

NAME_____

COMPANY_____

ADDRESS_____

CITY, STATE_____

Industrial CRANES

INDUSTRIAL CRANE & HOIST CORPORATION

(formerly Industrial Equipment Co.)

305 NORTH ADA STREET — CHICAGO 7, ILLINOIS

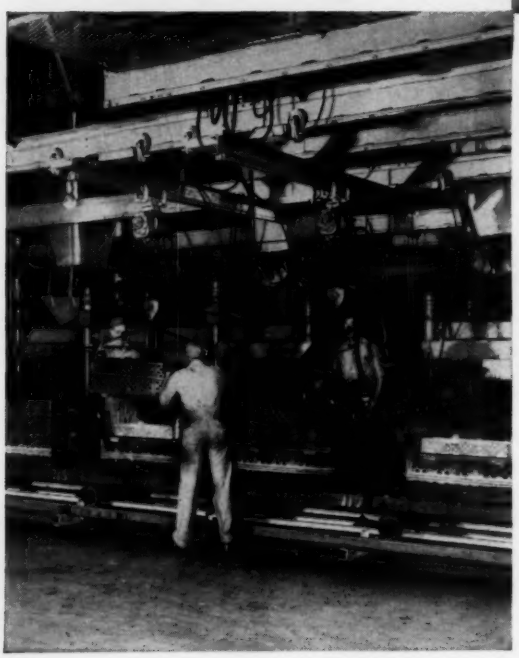
Overhead Cranes • Jib Cranes • Monorail Systems • Crane Runways
Representatives in Principal Cities

USE MONORAIL CRANES

. . . Where Space is Limited

. . . To Handle Variable Jobs

. . . For Low Maintenance Cost



These are just a few reasons why American MonoRail Cranes are gaining in popularity and are being installed in increasing numbers of plants the country over. Call in your American MonoRail representative and have him tell you all the advantages of MonoRail Cranes such as—ease of handling—smooth travel—strength—safety interlocks—power operation and **interlocking carrier service between and beyond the craneways.** Consultation in connection with any handling problem is available without obligation.

Send for your copy of C-1 Bulletin

AMERICAN OVERHEAD HANDLING EQUIPMENT

MONORAIL COMPANY

13122 ATHENS AVENUE • CLEVELAND 7, OHIO

BAKER PERKINS SIZE 14

BATCH TYPE UNIDOR CORE AND MOLDING SAND MIXER FOR JOB FOUNDRIES

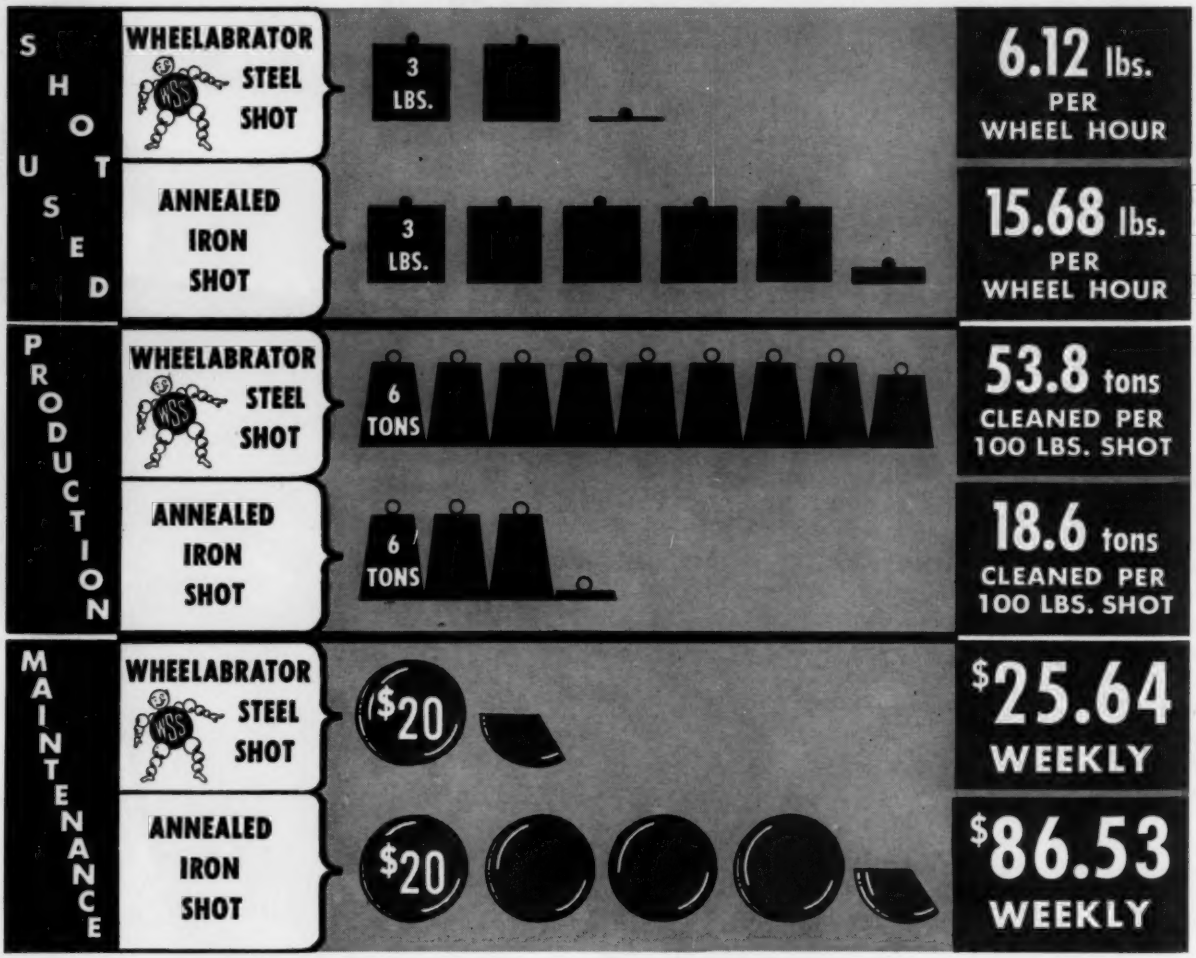
BAKER PERKINS Unidor Core and Molding Sand Mixers help speed up sand mixing operations and improve the quality of core and mold sand mixes so that you can produce good, clean castings that require less shakeout and machining time. These mixers rub, stir and knead in one operation without special aerating attachments. Gentle and thorough mixing action coats each grain of sand evenly with a thin layer of bond without breaking up the delicate silica grains. The mixed sand has a high degree of permeability, is homogeneous and does not require riddling.

BAKER PERKINS Unidor Sand Mixers are strong and well constructed with a simplified operating mechanism that helps keep maintenance and operating costs low. The No. 14 Mixer shown here has a fabricated steel trough shell and cast iron ends, renewable steel liners, and cast steel Sigma blades with renewable wearing shoes of hardened steel. It has a working capacity of 5.5 cu. ft. BAKER PERKINS Unidor Mixers are available for job foundries in capacities up to 35 cu. ft. These models can be adapted to or equipped with air or electrically operated skip hoists. A laboratory model with a working capacity of 1500 to 2000 grams is also available. For complete information, consult a BAKER PERKINS sales engineer or write us today.

BAKER PERKINS INC.
CHEMICAL MACHINERY DIVISION
SAGINAW, MICHIGAN

276

pioneering developments keep WHEELABRATOR® STEEL SHOT first in abrasives



How Gunite Foundries Corp. Saves

with Wheelabrator Steel Shot

Gunite Foundries Corp., Rockford, Illinois wisely switched to Wheelabrator Steel Shot for cleaning semi-steel castings in their Wheelabrator blast cleaning machine. They discovered this superior electric furnace steel shot came out on top on every count compared to the annealed iron shot previously used.

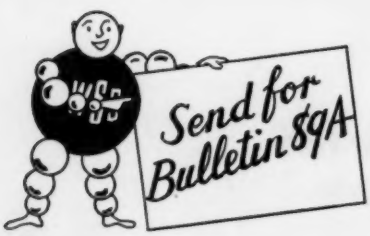
As illustrated in the chart above, important savings were realized in abrasive consumption, increased production and decreased maintenance. In addition, Gunite found a noticeable improvement in the cleanliness and surface appearance of their castings.

Every day more and more foundries of every type are switching to Wheelabrator Steel Shot. The reason is obvious: Performance records in these plants prove convincingly that the lowest overall cleaning costs are achieved with Wheelabrator Steel Shot.

Combining hardness with toughness, this superior shot will clean or peen faster, at lower costs, than any other abrasive. Try it and prove it for yourself.

PLUS

50 lb. Cartons and Palletizing. A Scheduled Delivery Plan.



American
WHEELABRATOR & EQUIPMENT CORP.
630 S. Byrkit St., Mishawaka, Ind.

WHEELABRATOR STEEL SHOT

NOW—

these cores dry in 1⅓ minutes ...INSTEAD OF 60!

This is typical of the time savings you can make with a *Foundromatic* core dryer! This unit dries cores in only a small fraction of the time required in conventional ovens . . . literally cuts drying time from hours to minutes.

The method is not only amazingly fast, but core quality is actually improved. Cores have a smooth finish and superior shakeout characteristics.

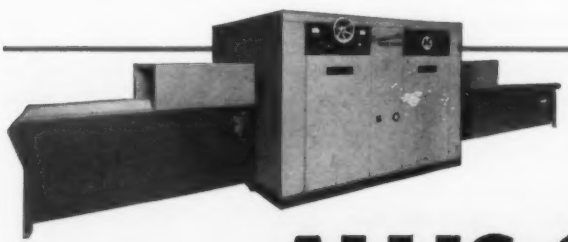
Using a *Foundromatic* dryer, it is no longer necessary to make cores ahead of time and build up a stock. Cores are not only dried fast, but come out of the dryer cool enough to handle bare handed, and ready to use.

60% SAVING IN HEAT COSTS

There's no waste heat! All heat goes into core. If there are no cores between electrodes, no energy is wasted. Result: low costs . . . no heat, smoke, fumes in core room.

Find out more about this modern core drying. Call your nearby Allis-Chalmers district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4346

Foundromatic is an Allis-Chalmers trademark.

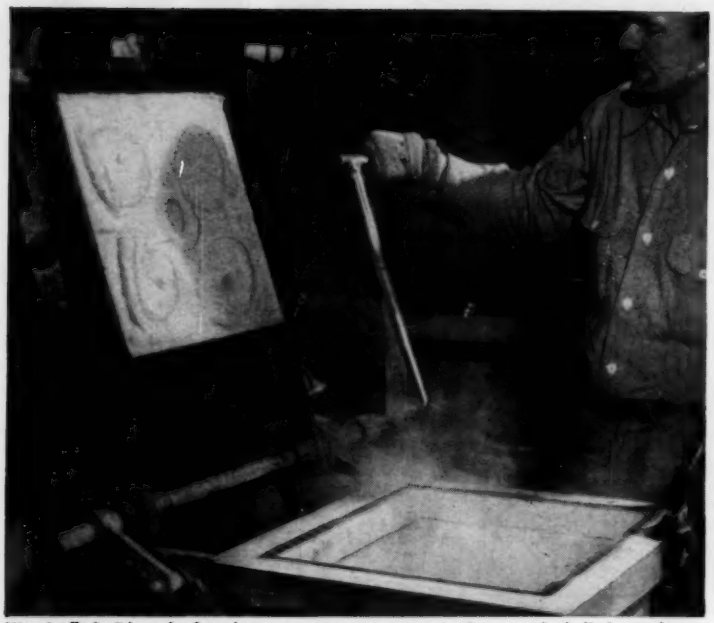


Get This Bulletin!
It is full of facts on dielectric sand core drying. Ask for 15B7306B.

ALLIS-CHALMERS

"We have cut in half with

—George P. Edwards



Woodruff & Edwards foundryman removes pattern and uncured shell from the investment box.

Resinox 714, when mixed with fine-grained sand, forms a thin-walled, rigid mold.

Learn how RESINOX 714 can help improve *your* foundry operation!

"We find that the shell molding process helps cut our customers' end-production cost – as much as 75 per cent in some cases," states Mr. Edwards.

A typical example he cites is a part which his company is presently producing at a cost of $3.70 a unit compared to the former cost of $6.90 each. This savings came from reduced machining and less material, with resultant lower shipping and handling costs.

Operator ejects shell from pattern on a shell molding machine built by Woodruff & Edwards.

A leader in shell molding among the midwest's gray iron foundries, Woodruff & Edwards is principally a jobbing shop, and considers its shell molding operation a very profitable venture. They are currently holding castings to a plus-or-minus .003″ per inch, depending on casting design, and plus-or-minus .010″ per inch across the parting line. And many foundries are finding that thinner sections and more intricate shapes with much finer detail can be cast, using Resinox 714.

Shell molding engineer, Wayne Wright, of Woodruff & Edwards, says, "We have used Resinox 714 in larger quantities than any other resins and find it meets our needs . . . helps produce castings to the most exacting specifications."

Mr. Wright reports *an increase in metal yield*, plus a *large saving in sand handling*. For instance, a 14 x 16 inch shell mold, using

Inspecting the shell after it is removed from the pattern. Note the detail.

production costs shell molding!"

Woodruff & Edwards, Inc., Elgin, Illinois

Resinox 714, weighs about *seven pounds,* whereas a green sand mold of the same size would require about 60-80 pounds of sand.

Far less cleaning of the finished product is needed with shell molded parts, states Mr. Wright, with grinding required only at the gates and core print. There is also more allowance for flexibility of product design —and surface areas are comparable to a permanent mold finish. Much finer sands can be used without resultant gas inclusion. "Clean, sharp edges, such as gear teeth, can be cast – and the parts used as cast," says Mr. Wright.

"Chill or scale is also practically eliminated on the outer edges of the casting sections," states Mr. Wright. "This means less allowance for finish stock, and longer tool life. Internal stresses are minimized because shell molds promote directional solidification."

Plant engineers find that shell molding, with Resinox 714, saves about 80 per cent of floor space, increasing square-foot productivity at a corresponding rate. Woodruff & Edwards shell mold aluminum and brass pieces as well as gray iron.

Learn how Resinox 714 and Monsanto's other foundry resins can meet your exact needs and improve your productivity. Mail the coupon today for complete details. And for the full story on Monsanto's complete line of foundry resins, be sure to visit the Monsanto exhibit (Booth 1326-30) at the Cleveland foundry show. Resinox: Reg. U. S. Pat. Off.

Here the shells are assembled. The good permeability, insulating properties, strength and smoothness of a sand-Resinox 714 shell permit precise dimensional accuracy.

Molten metal is poured into the mold. The permeability of a sand-Resinox 714 shell mold permits gases to escape, eliminates many metallurgical defects such as blowholes, porosity, and cold shuts.

MONSANTO

SERVING INDUSTRY.....WHICH SERVES MANKIND

MONSANTO CHEMICAL COMPANY, Plastics Division, Room 5604,
Springfield 2, Mass.
Please send me complete information on:
.....Resinox 714 phenolic resin; .....other Monsanto shell molding resins; .....Monsanto core binding resins;
.....Lytron sand conditioner.

Name & Title _____

Company _____

Address _____

City, Zone, State _____

Power-Packed for Profit...

SHOT OR GRIT . . . that's Malleabrasive. Malleabrasive is scientifically heat-treated and laboratory controlled to clean *better, faster,* and last *longer*. Malleabrasive cleans *cheaper* because you save on parts repair and down-time . . . because its long life cuts abrasive purchases. Don't take our word for it. Prove it to yourself. Next time you buy blast cleaning abrasive, specify Malleabrasive from Pangborn Corporation, 1300 Pangborn Blvd., Hagerstown, Md.

Look to Pangborn for the right abrasive for every blast cleaning job.

Pangborn DISTRIBUTORS FOR **MALLEABRASIVE®**

U. S. Patent #2184926 (other patents pending)

Pangborn BLAST CLEANS CHEAPER with the right equipment for every job

Cut core costs...

double core production with

FOUNDREZ 7101

Your cores will cost less per ton, and bake out faster, if you switch from ordinary core oils to RCI's FOUNDREZ 7101 — a water-dispersing, phenol-formaldehyde binder.

Because FOUNDREZ-bonded cores bake out in about half the time of oil-bonded cores, you can double your production without adding any extra oven equipment.

What's more, you get a superior core. Tensile strength and hardness are greater. Permeability is increased. Gassing is reduced. Hot strength is higher. Less cereal binder is needed. And shake-out is better, saving time and material in cleaning finished castings.

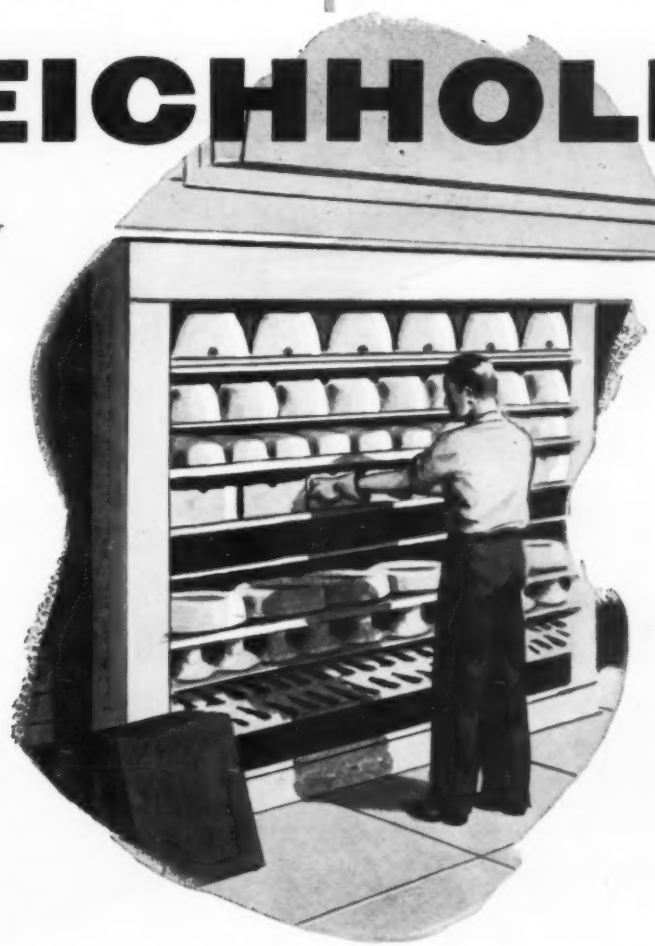
Get the full facts on FOUNDREZ 7101 by writing for Technical Bulletin F-1.

REICHHOLD CHEMICALS, INC. | 525 NORTH BROADWAY, WHITE PLAINS, N. Y.

REICHHOLD

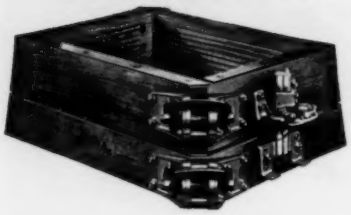
RCI

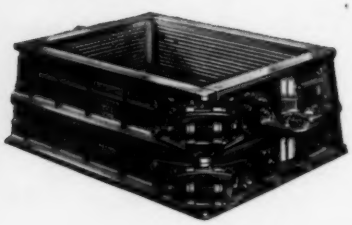
Creative Chemistry ...
Your Partner
in Progress

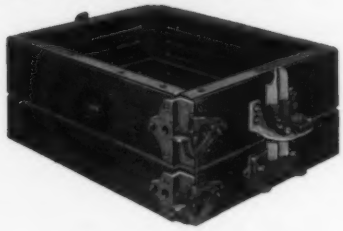


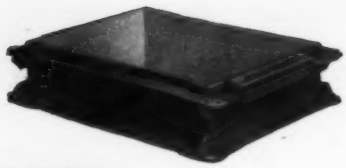
Synthetic Resins
Chemical Colors
Phenol
Glycerine
Phthalic Anhydride
Maleic Anhydride
Sodium Sulfate
Sodium Sulfite

ADAMS FLASK EQUIPMENT





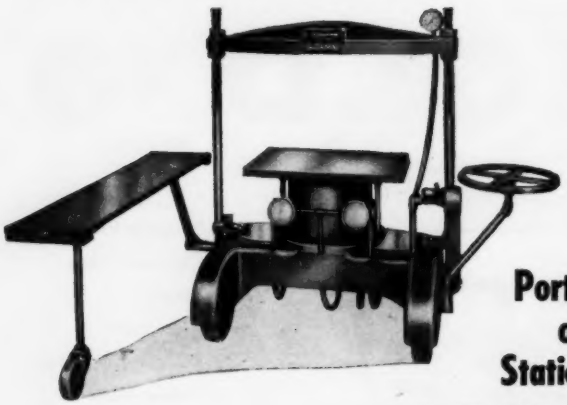




SNAP FLASKS
SLIP FLASKS
EASY OFF FLASKS
FLASK UPSETS

BANDS
JACKETS
BOTTOM BOARDS
STEEL BOTTOM PLATES

ADAMS MOLDING MACHINES



Portable or Stationary

Side Rod Type or Post Type

JOLT SQUEEZERS . . . UNIVERSAL JOLT SQUEEZERS . . . HAND SQUEEZERS

Visit Our Booth — AFS Foundry Show

MAY 8-14 — CLEVELAND, OHIO

The ADAMS Company

ESTABLISHED 1883

MOLDING MACHINES and FLASK EQUIPMENT

DUBUQUE, IOWA, U.S.A.

Sterling INVITES YOU to the 1954 Cleveland Parade of Foundry Progress!

1904
GOLDEN ANNIVERSARY
1954

Sterling
STEEL FLASKS
used in more than 13,000 FOUNDRIES all over the world.

Come to Cleveland, May 8th to 14th . . . see the exhibits at American Foundrymen Society's 58th Convention . . . study the progressively modern processes and machines . . . review the soundly engineered advantages Sterling offers you in Foundry Flasks that have won world-wide leadership. In addition to their unequalled combination of maximum strength and minimum weight, Sterling Foundry Flasks have foundry-favored features you need. Practical foundrymen prefer the Sterling line. Now over 13,000 foundries, world-wide, use them. Write for "Sterling's Golden Anniversary Catalog" . . . or see your nearby Sterling Branch Office or Dealer.

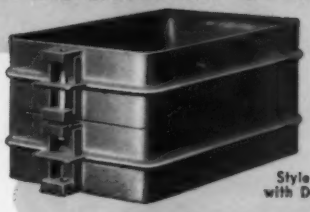
STERLING WHEELBARROW COMPANY
MILWAUKEE 14, WISCONSIN, U. S. A.
Subsidiary Company: STERLING FOUNDRY SPECIALTIES LTD., ENGLAND

Sterling **...THE ORIGINAL and ONLY**
Rolled Steel Channel
FOUNDRY FLASKS

Sterling EQUIPMENT for HEAVY-DUTY FOUNDRY SERVICE

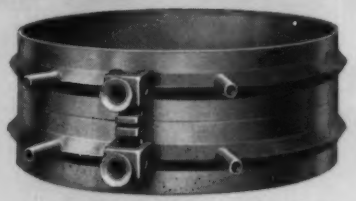
FOUNDRY CARTS and TRUCKS: Designed and built for tough foundry service, the Sterling line of wheelbarrows, carts and trucks can be depended upon to take everyday punishment. Cost less per year of service.

FOUNDRY FLASKS and ACCESSORIES: Special rolled steel channel, reinforced and welded into one solid, rigid unit, permits Sterling Foundry Flasks to resist tremendous pressures. Maximum strength is combined with light weight to make these the preferred foundry flasks throughout the world.



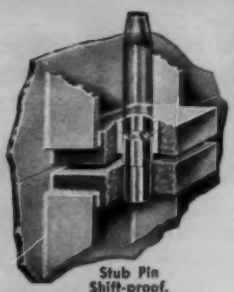
Style AD Flask with Double Lugs.

No. 116-A Heavy-Duty Wheelbarrow

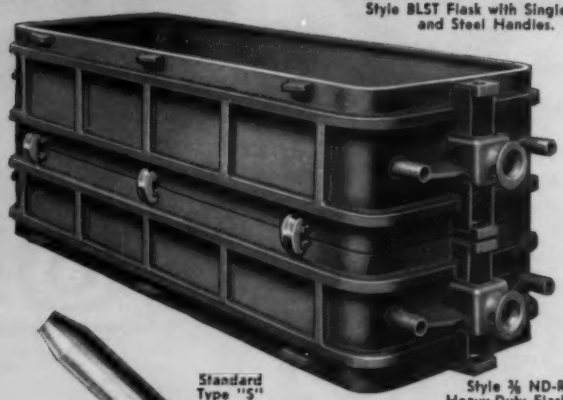


Style BLST Flask with Single Lugs and Steel Handles.

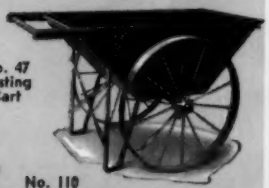
No. 50 Slag Buggy



Stub Pin Shift-proof.



Style ¾ ND-RTX Heavy-Duty Flask with Reinforcing Strips.

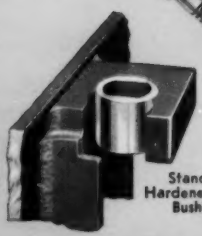


No. 47 Casting Cart

Standard Type "S" Flask Pin.

No. 110 Core Truck

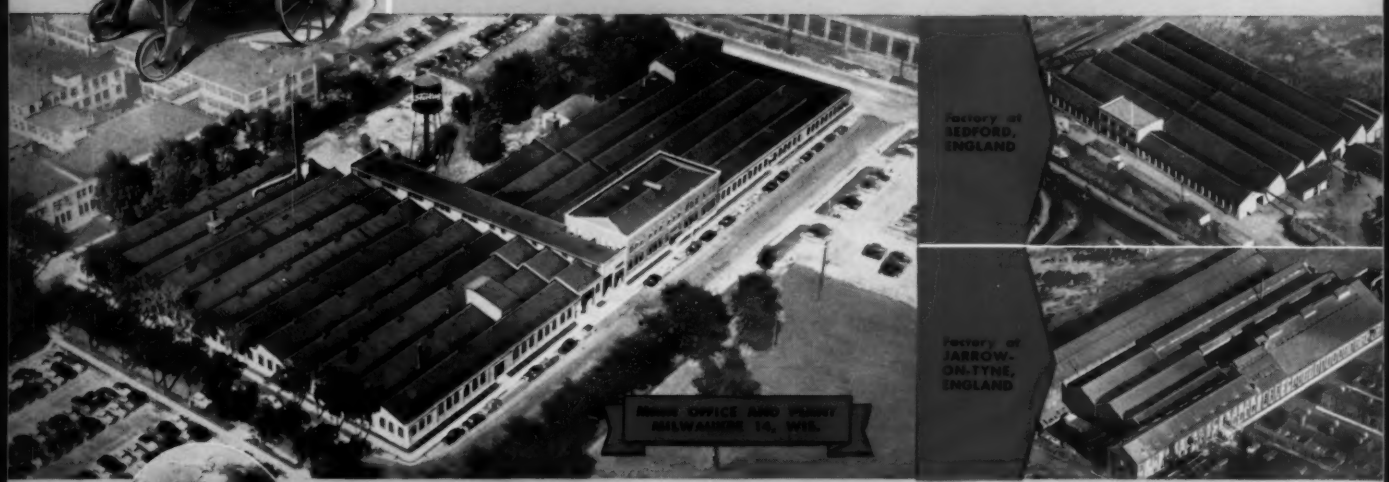
Squeeze-in Board.



Standard Hardened Steel Bushing.

Sterling Flask Clamp.

No. 160 Heavy-Duty Casting Truck



WORLD WIDE SERVICE

STERLING WHEELBARROW COMPANY

MAIN OFFICE and PLANT: MILWAUKEE 14, WISCONSIN, U. S. A.

Subsidiary Company: STERLING FOUNDRY SPECIALTIES LTD., ENGLAND

SALES OFFICES AT LONDON and BEDFORD — FACTORIES AT BEDFORD and JARROW-ON-TYNE

AJAX

LO-VEYORS on parade

at the FOUNDRY SHOW in Cleveland Booth 1612 Lower Lakeside Hall

AJAX LO-VEYORS are being welcomed throughout the foundry industry as the cost saving successors to shovels, wheelbarrows and expensive unskilled labor.

AJAX LO-VEYORS are used in custom as well as high production foundries.

AJAX LO-VEYORS are being installed on or below the floor. They can be arranged for dual functions including conveying sand and sorting tramp iron and core rods.

Typical Ajax Lo-Veyor handling spill sand from molding lines in a large foundry. This unit is 55' long, made in a single section with saddle-mounted drive unit. No exposed rotating bearings,—ideal for use under abrasive conditions.

AJAX LO-VEYORS are used as component parts by America's leading manufacturers of foundry equipment as well as by individual foundries who are awake to today's importance of cutting down non-productive labor costs.

It will pay you to see Ajax Lo-Veyors at the Show.

AJAX FLEXIBLE COUPLING CO. INC.

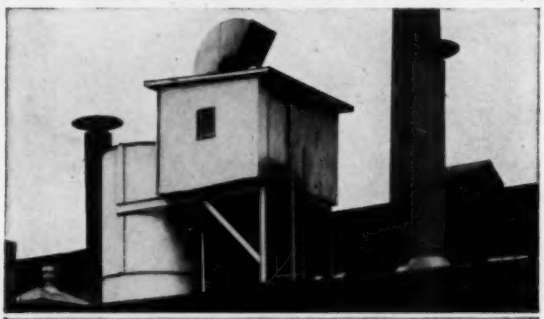
Representatives in Principal Cities

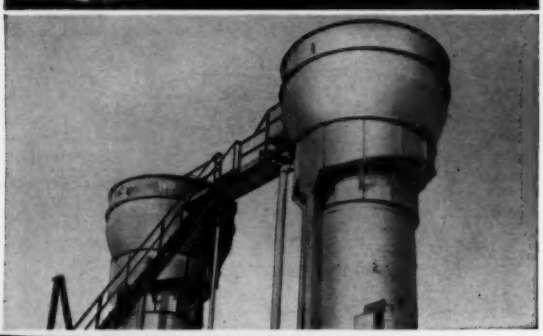
WESTFIELD, N. Y.

MEMBER FEMA FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC.

Small foundries—too,
BUY SCHNEIBLE EQUIPMENT FOR BETTER DUST CONTROL!

AT THE FOUNDRY SHOW VISIT OUR BOOTHS 1425-1427





The smaller foundries — too, are users of Schneible Dust Control Equipment. Like the large production foundries, they have found Schneible has the experience and the equipment best suited for all foundry dust control.

The Schneible line of Multi-Wash Collectors, Uni-flo Shakeout Hoods, Cupola Collectors and auxiliary units has been designed with all types and sizes of foundries in mind.

If you are considering any dust control equipment *be sure* to include a quotation from Schneible. You'll be offered equipment that suits your requirements at a price that is within your budget.

Contact the local Schneible representative or write or phone direct for detailed information.

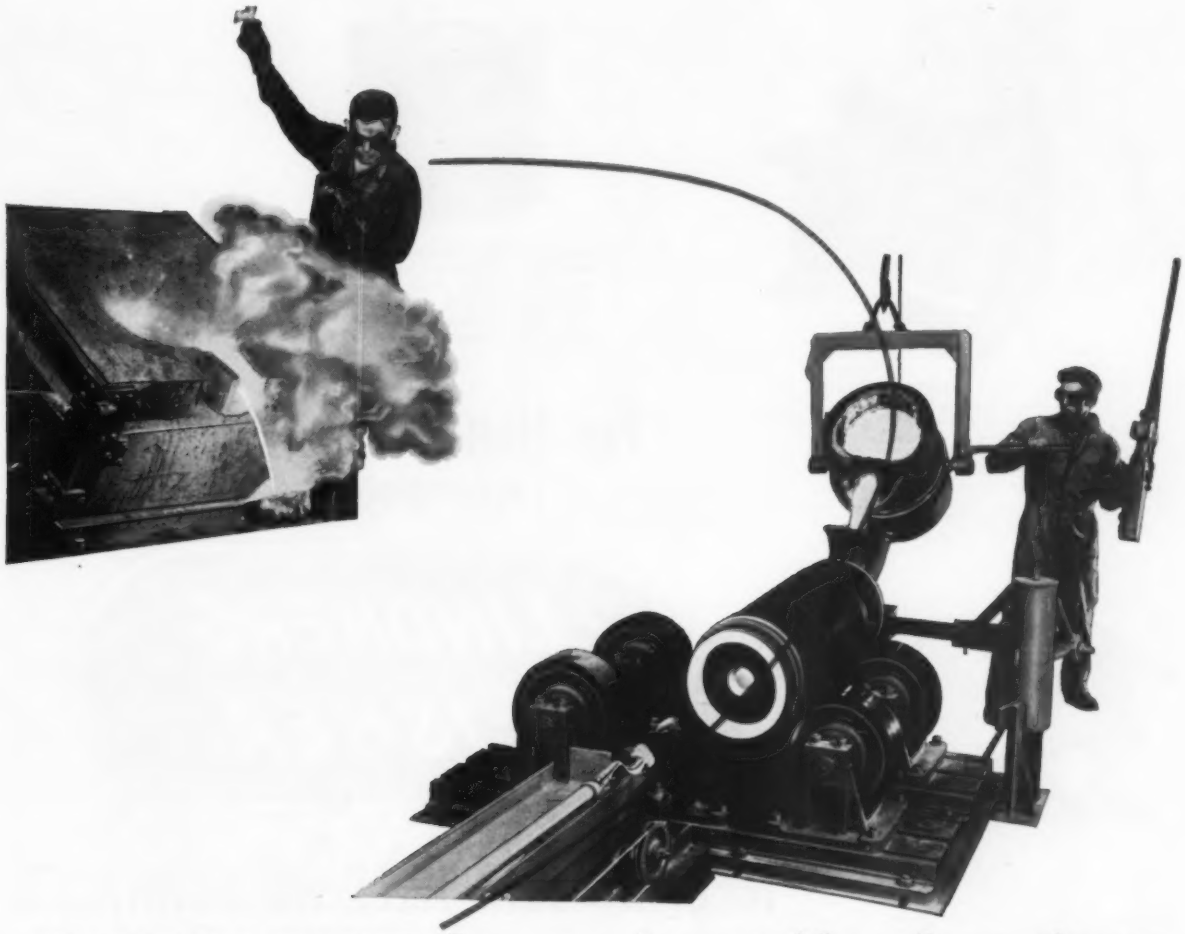
SCHNEIBLE

Cable Address: CBSCO
European Licensee: Elex S. A., Zurich, Switzerland

CLAUDE B. SCHNEIBLE COMPANY
P. O. Box 81, North End Station • Detroit 2, Michigan

PRODUCTS

Multi-Wash Collectors • Uni-Flo Standard Hoods • Uni-Flo Compensating Hoods • Uni-Flo Fractionating Hoods • Water Curtain Cupola Collectors • Ductwork • Velocitrap • Dust Separators • Entrainment Separators • Settling and Dewatering Tanks • "Wear Proof" Centrifugal Slurry Pumps



STARTING POINT for good centrifugal castings

All good casting starts in the melt with more accurate control of temperature and closer control of chemical composition. These are both *inherent advantages* of Ajax-Northrup High Frequency, Hi-Speed Induction Furnaces.

Accurate analysis is simply achieved and continuously maintained by fast melting . . . with practically no chance for oxidation. Alloying is easy because losses are negligible . . . you get out what you put in. And, even with elements of widely dissimilar densities, you pour metal of uniform composition since the melt is constantly, thoroughly stirred by electromagnetic action inherent to the furnace principle.

In actual production with an Ajax-Northrup Furnace, alloying elements can be controlled usually within 0.25%; carbon within 0.01 or 0.02%. Melts can be reproduced . . . each time with identical composition . . . or alloys may be varied quickly. Pouring temperature, especially important in centrifugal and precision casting, may be maintained exactly as desired.

Practical savings with Ajax-Northrup Hi-Speed Melting are found in the almost complete recovery of alloying elements. Savings are also realized in an overall reduction in rejects and subsequent grinding operations.

TECHNICAL DATA AVAILABLE: Tell us what you're melting . . . and in what quantities. We'll send you the proper bulletins.

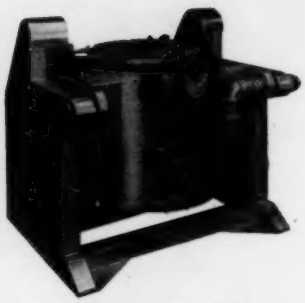
543

AJAX NORTHRUP SINCE 1916

INDUCTION HEATING-MELTING

AJAX ELECTROTHERMIC CORPORATION • AJAX PARK, TRENTON 5, NEW JERSEY

Associated Companies: Ajax Electrometallurgical Corp. • Ajax Electric Furnace Co. • Ajax Electric Company, Inc. • Ajax Engineering Corp.



Lindberg-Fisher type MNP nose-pour tilting crucible furnace. Pouring lip is located in the axis of tilting providing a constant pouring arc regardless of degree of furnace tilt. Capacities up to #800 crucible with brass, up to #1000 crucible with aluminum. Oil or gas fired. Described in Bulletin 57-A.

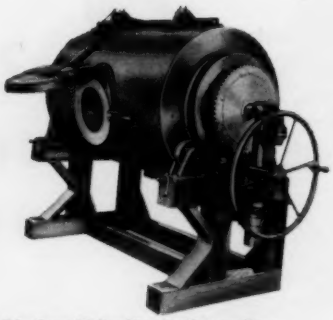
Lindberg-Fisher Electric Resistance Melting and Holding Furnace equipped with heavy duty resistance elements which give uniform distribution of heat, insuring long element and pot life. Capacities 250 to #1000 crucible.

For Non-Ferrous Metals

A complete line of

LINDBERG FISHER

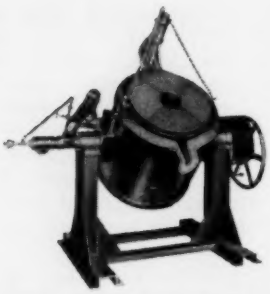
MELTING AND HOLDING FURNACES



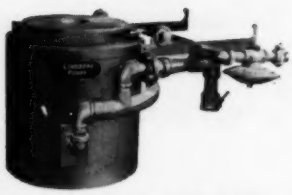
Lindberg-Fisher Simplex Rotary Open-Flame Furnace. Capacities to 2400 lbs. aluminum. 6000 lbs. brass. Oil or gas fired. Described in Bulletin 29-A.

For Melting Aluminum • brass • yellow brass bronze • copper • copper nickel alloys • lead magnesium • nickel • tin • zinc.

Because Lindberg-Fisher builds *all* kinds of melting equipment... gas... oil... electric... induction, and Carbon arc... L-F engineers are able to recommend, without prejudice, the proper type of furnace for *your* particular melting requirements.



Lindberg-Fisher type BB1 Hand-Tilt Crucible Furnace. Tilting mechanism consists of a hand wheel, driven through machined worm gear and pinion reducing gears. Capacities 50 to #400 crucible. Oil or gas fired. Described in Bulletin 400.



Lindberg-Fisher type SF stationary crucible furnace features rapid melting and is recommended for general foundry casting work. Capacities 30 to #400 crucible. Oil or gas fired. Described in Bulletin 301.

Melting specialists for 25 years
Sales and service offices in principal cities

Visit Lindberg-Fisher exhibit at the Foundry Show, May 8th through 14th, Cleveland, Ohio

LINDBERG FISHER **MELTING FURNACES**

A Division of Lindberg Engineering Company, 2440 West Hubbard Street • Chicago 12 • Illinois

For Permanent Mold Castings

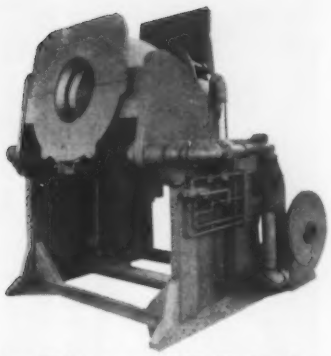
A complete line of

LINDBERG FISHER

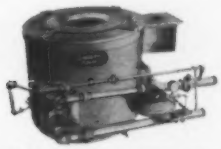
ALUMINUM MELTING and HOLDING FURNACES

Lindberg-Fisher manufactures all types of Aluminum Melting and Holding Furnaces for permanent mold application—Gas-Oil-Electric resistance.

Lindberg-Fisher engineers can intelligently recommend the type of furnace to best suit your needs and conditions.

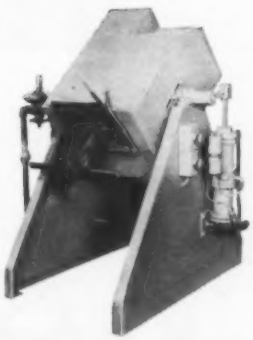


Lindberg-Fisher type HNP Hydraulic Nose-Pour Tilting Crucible Furnace. Pouring lip is located in the axis of tilting providing a constant pouring arc regardless of degree of furnace tilt. Capacities up to 1000 lbs. of aluminum. Oil or gas fired. Described in Bulletin 57-A.



Lindberg-Fisher type ADC Aluminum Melting and Holding Furnace. Capacities up to 1000 lbs. of aluminum. Oil or gas fired. Described in Bulletin 301.

Lindberg-Fisher Electric Resistance Aluminum Melting and Holding Furnace equipped with heavy duty resistance elements which give uniform distribution of heat, insuring long element and pot life. Capacities up to 1000 lbs. of aluminum.

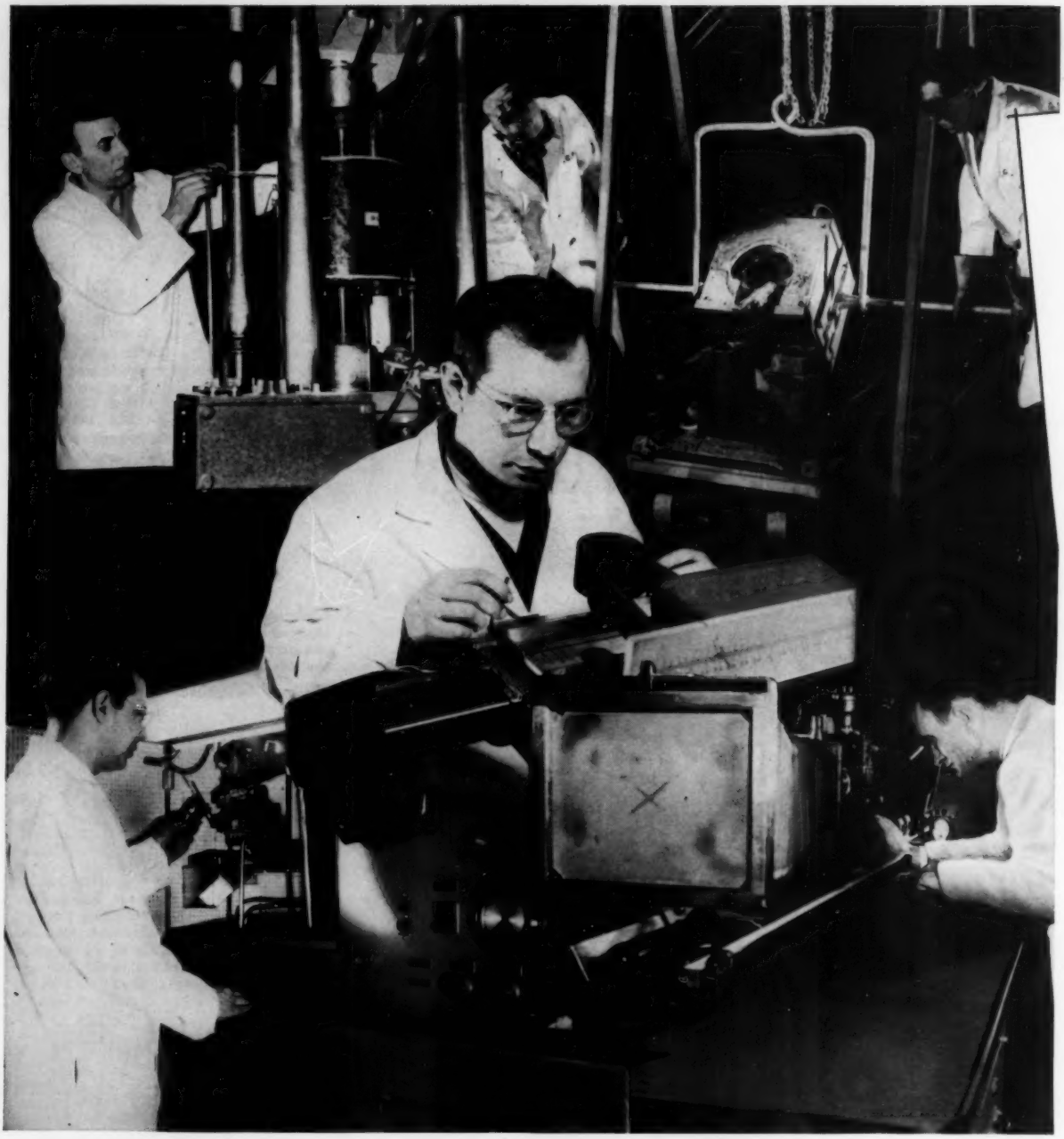


Lindberg-Wessel Casting Machine produces quality aluminum castings on a semi-automatic basis using either graphite or steel molds which are attached to the machine. Described in Bulletin LW.

Melting specialists for 25 years
Sales and service offices in principal cities

LINDBERG FISHER MELTING FURNACES

A Division of Lindberg Engineering Company, 2440 West Hubbard Street • Chicago 12 • Illinois



Scientists and engineers at the new VCA Research Center—working with complete, modern facilities for metallurgical research of every type—stand ready to help you find solutions to your most difficult technical problems.

VANCORAM BRAND

Producers of alloys, metals and chemicals

Initial building of the new Vanadium Corporation Research Center at Cambridge, Ohio.

VANADIUM CORPORATION OF AMERICA

GRAYBAR BUILDING

420 LEXINGTON AVENUE

NEW YORK 17, N. Y.

WILLIAM C. KEELEY
PRESIDENT

An important message to the metals industry

On December 1, 1953, Vanadium Corporation of America opened at Cambridge, Ohio, the initial building of its new Research Center.

The new Center is dedicated to just one end: to help you develop and produce ever better, ever more versatile metals through helping you find new, practical solutions to your most difficult technical problems.

To achieve that end, we have made the new Center what we believe to be one of the finest of its type anywhere in the metals industry.

We have made it a living symbol of the traditions, the achievements, the ultimate goals shared by Vanadium Corporation and the metals industry as a whole — as well as a new means to future service and prosperity for both.

We cordially invite you to visit our new Research Center next time you are in the vicinity.

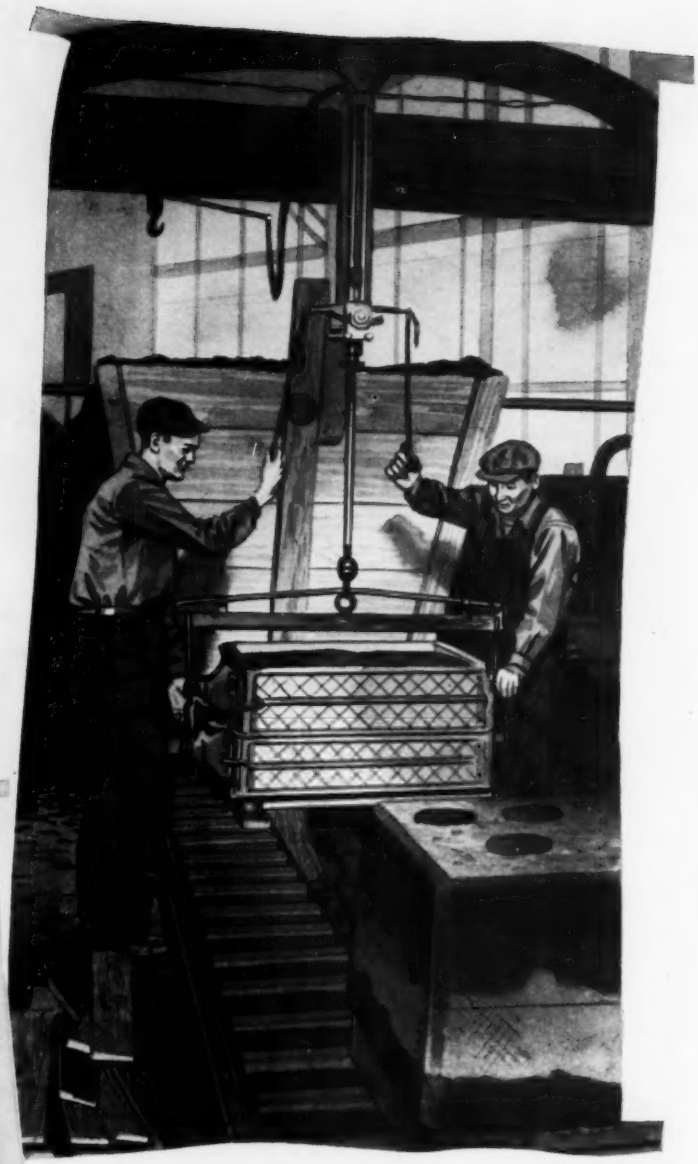
President

Vanadium Corporation of America

..be sure with a

NATIONAL BENTONITE

bond!



A dependable National Bentonite bonded mold means better production, better castings, less time in the cleaning room. Many experienced foundrymen have relied on National Bentonite for years because of consistently uniform high quality . . . good green strength . . . high hot strength . . . high sintering point . . . good mold durability . . . and because it requires the least water to temper correctly. You, too, can be sure of better bonds with NATIONAL BENTONITE. Quick service from better foundry suppliers everywhere.

Baroid

Baroid Sales Division ☆ National Lead Company

Bentonite Sales Office: Railway Exchange Building, Chicago 4, Illinois

4721

Control Foundry Chilling with...

CHILL KOOLHEAD NAILS

CHILL NAILS and SPIDERS in many types and sizes

Choose any style chill nail from jumbo to stubby; slim, medium, or horse nail blade; blunt, pointed, straight or 90° bent. Same types available in Stainless, Brass, Aluminum; Copper coated to order. Spider Chills, jumbo or horse nail legs—double or single. Available in various sizes and types; also made to your individual specifications. Whatever your chill job, rely on "KOOLHEAD."

Equally reliable—the "STANHO" precision quality line of Taper Pins, Woodruff Keys, Machine Keys, Cotter Pins, Straight Pins, Knurled Pins and all sorts of finished specialties and made-to-order parts.

Write for detailed descriptions and prices.

Other Quality Products

STEEL Stanho PRODUCTS

PINS KEYS

SPECIAL PARTS

STANDARD HORSE NAIL CORP.

Since 1872

NEW BRIGHTON, PA.

F-4

You are cordially invited to visit us at the Annual Foundry Congress and Show, Cleveland, May 8-14, Booth No. 321

ALSIMAG®

FOUNDRY CERAMICS

NOT AFFECTED BY MOISTURE

WILL NOT ERODE

ECONOMICAL!

- *Accurate and uniform.*
- *Completely free of gas.*
- *Non-spalling.*
- *Strong, will stand the roughest handling.*
- *Do not contaminate scrap.*

FREE TEST SAMPLES OF STANDARD SIZES ON REQUEST

Samples made to your own specifications at moderate cost.

WRITE FOR BULLETIN 532

AMERICAN LAVA CORPORATION

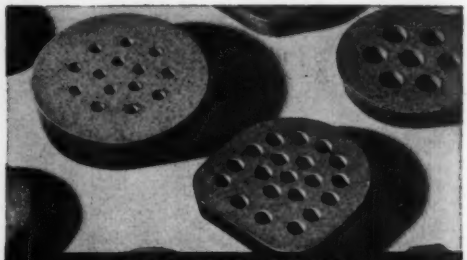
A SUBSIDIARY OF MINNESOTA MINING AND MANUFACTURING CO.

CHATTANOOGA 5, TENNESSEE

REPRESENTATIVES:

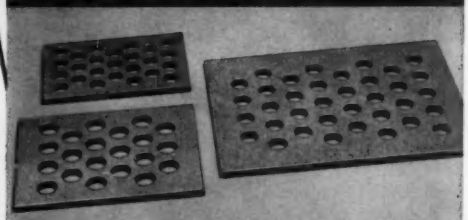
M. A. BELL CO., 217 Lombard St., St. Louis, Mo. • 3201 Sherman St., Houston, Texas • 3430 Brighton Blvd., Denver, Colo. • CANADIAN FOUNDRY SUPPLIES & EQUIPMENT LTD., 4295 Richelieu St., Montreal 30, Quebec • 49 Main St., Toronto 14, Ontario • E. J. WOODISON CO., 7415 St. Aubin Ave., Detroit 11, Mich. • 146 Chandler St., Buffalo 7, N. Y. • FRED H. McGEE, 120½ E. 7th St., Chattanooga, Tenn. • SMITH-SHARPE CO., 117 27th Avenue, S. E., Minneapolis, Minn. • SNYDER FOUNDRY SUPPLY CO., 2444 East 57th Street, Los Angeles 58, California • INDIANA PRODUCTS CO., 400 Union Bank Bldg., Kokomo, Ind. • HOFFMAN FOUNDRY SUPPLY CO., 1193 Main Ave., Cleveland, Ohio • EASTERN FOUNDRY SUPPIES, INC., 109 Frelinghuysen Ave., Newark 5, N. J. • SPRINGFIELD FACING CO., N. Chicopee St., Willimansett, Mass.

52ND YEAR OF CERAMIC LEADERSHIP



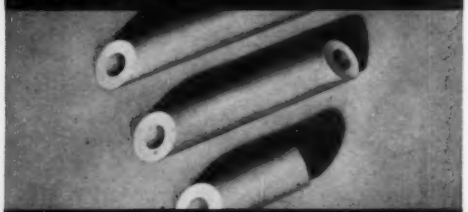
STRAINER CORES

14 standard sizes in stock for immediate shipment. Special AlSiMag cores can be produced at low cost. More economical than shop made sand cores!



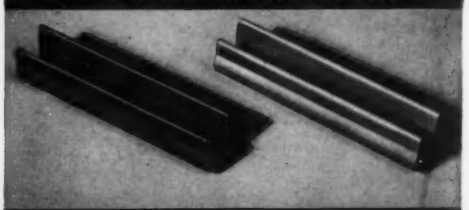
CUT-OFF CORES

Form an easily separated joint between riser and casting. This enables the riser to be broken off after shake out, eliminating cut off time.



GATE TUBES

Metal flows through a smooth ceramic tunnel gate, assuring slag-free, sand-free castings. Economical to use where better castings are desired.



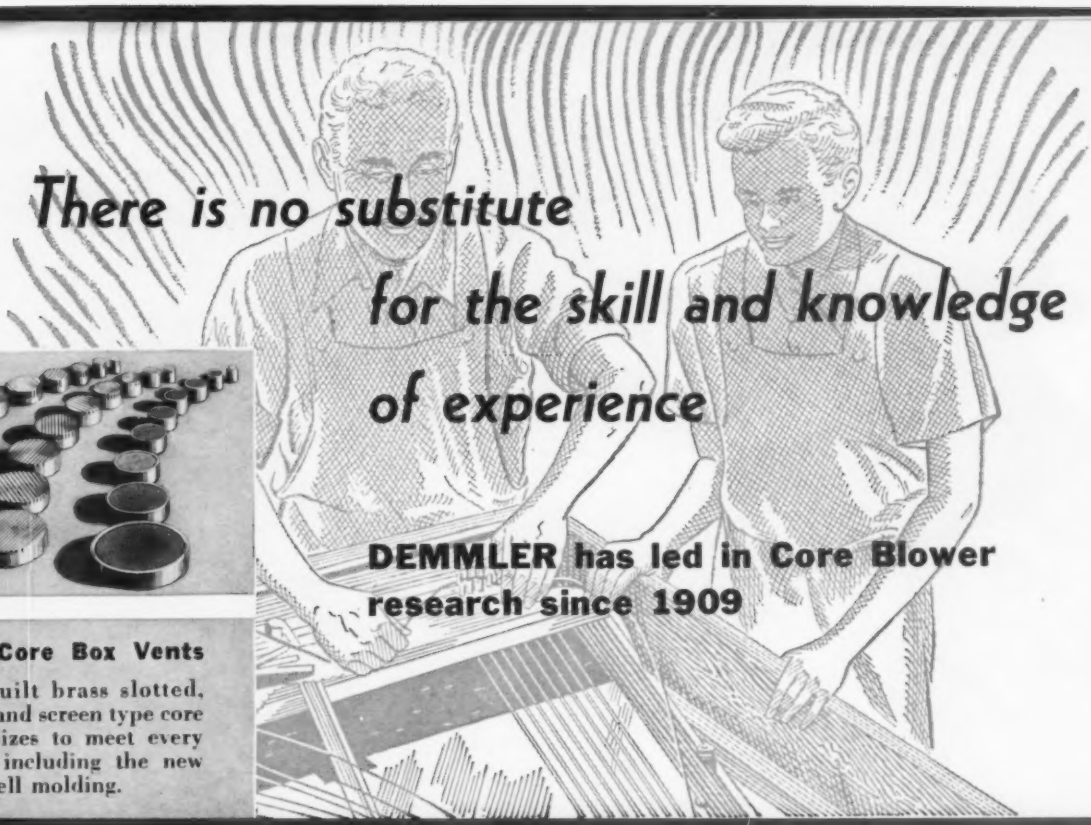
TROUGHS

For conveying molten metal — often great time-savers. Outline requirements and let us submit recommendations.

PRECISION CORES

Used mostly in lost wax casting process. Made to close tolerances. An economical and accurate method of forming holes, threads, etc.

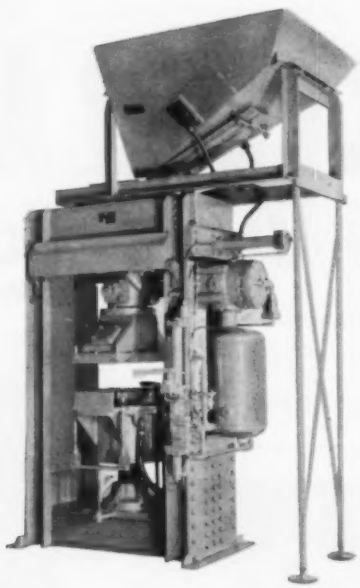
There is no substitute for the skill and knowledge of experience



DEMMLER has led in Core Blower research since 1909

Demmler Core Box Vents

Precision built brass slotted, steel slotted and screen type core box vents. Sizes to meet every application, including the new D-process shell molding.



DEMMLER
Model "100" Series
Core Blowers

The Demmler "100" Series, built with the skill and care of the old experienced craftsman, includes four leading models. They are designed for high speed operation and have turned out as many as 2,000 cores per hour on a certain defense project. All machines in this series have a 10" draw stroke of which any part or all may be used, and all can be furnished with manual or semi-automatic controls. Vibratory sand feeders, horizontal clamps and Timken roller equipped conveyor table are available as optional equipment. Write for detailed specifications on the four important models in the Demmler "100" Series. See what Demmler experience can do for your core production.

Write for literature

Wm. Demmler & Bros., *Kewanee, Illinois*

CLIFFORD B. CORNELL
Sec'y-Treas.

CLIFF. Says-

"The Foundry Show without"

FAS

CLEVELAND
MAY 8 to 14

Closed Sunday, May 9.

Famous Cornell Flux Exhibit at Foundry Show, Atlantic City 1952

will not be complete seeing you"

COME TO BOOTH NO. 125

CLEVELAND PUBLIC AUDITORIUM

Come in and talk over old times, and should you have casting problems, bare them to us. We have saved the industry many thousands of dollars by minimizing rejects.

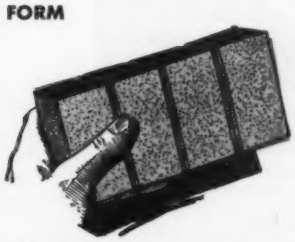
But our welcome doesn't end here. After closing hours, you are invited to join our social gathering and entertainment in our suite in Hotel Auditorium.

HOTEL AUDITORIUM
Across the Street from
Cleveland Public Auditorium

Famous CORNELL CUPOLA FLUX

Conditions Iron for Better Castings

SCORED BRICK FORM



Used by leading gray iron foundries and malleable foundries with cupolas.

Use a little with each cupola charge and your iron will be clean, more fluid and sulphur greatly reduced. Castings will be cleaner and sounder—your scrap loss *minimized*.

REDUCES CUPOLA MAINTENANCE, TOO. You save much labor because drops are cleaner and bridging over is practically eliminated. There is less patching due to a glazed or vitrified protective surface which is formed on brick or stone.

Scored Brick Form insures easy use. No digging out of container, no weighing, no measuring.

WRITE FOR BULLETIN No. 46-B

The Cleveland Flux Co.

1026-1040 MAIN AVENUE, N. W., CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes – Since 1918

FAMOUS CORNELL FLUXES
Trade Mark Registered

BRASS FLUX

FAMOUS CORNELL BRASS FLUX cleanses molten brass even when the dirtiest brass turnings or sweepings are used. You pour clean, strong castings which withstand high pressure tests and take a beautiful finish. The use of this flux saves considerable tin and other metals, and keeps crucible and furnace linings cleaner, adds to lining life and reduces maintenance.

ALUMINUM FLUX

FAMOUS CORNELL ALUMINUM FLUX cleanses molten aluminum so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Exclusive formula reduces obnoxious gases, improves working conditions. Dross contains no metal after this flux is used.

COLEMAN...the only complete

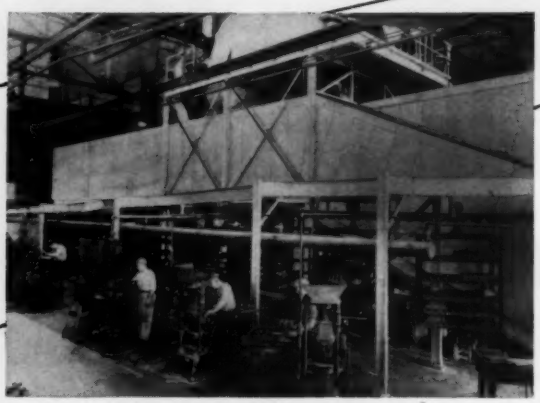
Only Coleman Ovens can improve production and lower costs for core baking and mold drying regardless of your requirement because only Coleman makes a complete line of ovens...and can recommend the best for your purpose.

The proper selection of core and mold ovens is vital to profitable foundry operations. Coleman Ovens are built in types to fit each need exactly...and quickly pay for themselves out of direct savings in labor, materials, and reduced losses.

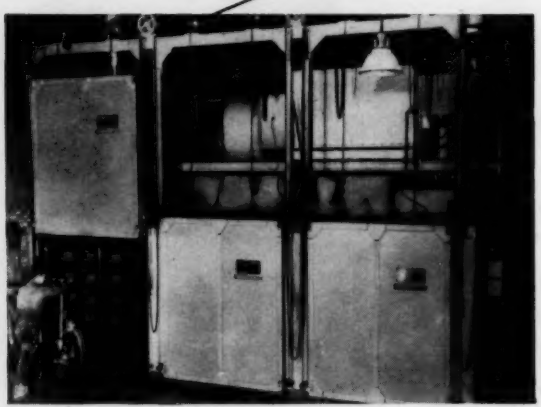
Benefit from 50 years of exclusive specialization in the design and construction of foundry ovens. Profit by this knowledge when you are considering a new oven installation. Coleman Oven engineers are available without obligation to make practical, unbiased recommendations for your particular requirements.

WRITE FOR BULLETIN 54

Coleman Dielectric Core Oven



Coleman Monorail Conveyor Core Oven



Coleman Transrack Core Ovens

Coleman Car Type Core Oven

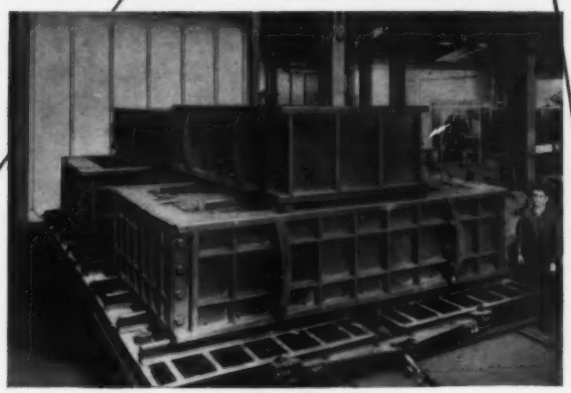
*Let us recommend the **RIGHT** type of core or mold oven for your requirements—we make them ALL!*

COLEMAN TOWER OVENS	COLEMAN PORTABLE MOLD DRYERS	COLEMAN HORIZONTAL CONVEYOR OVENS
COLEMAN DIELECTRIC CORE OVENS	COLEMAN CONTINUOUS MOLD OVENS	COLEMAN ROLLING DRAWER OVENS
COLEMAN CAR TYPE CORE OVENS	COLEMAN CONTINUOUS REDRY OVENS	COLEMAN PORTABLE OVENS
COLEMAN CAR TYPE MOLD OVENS	COLEMAN TRANSRACK OVENS	COLEMAN HEAT TREAT OVENS

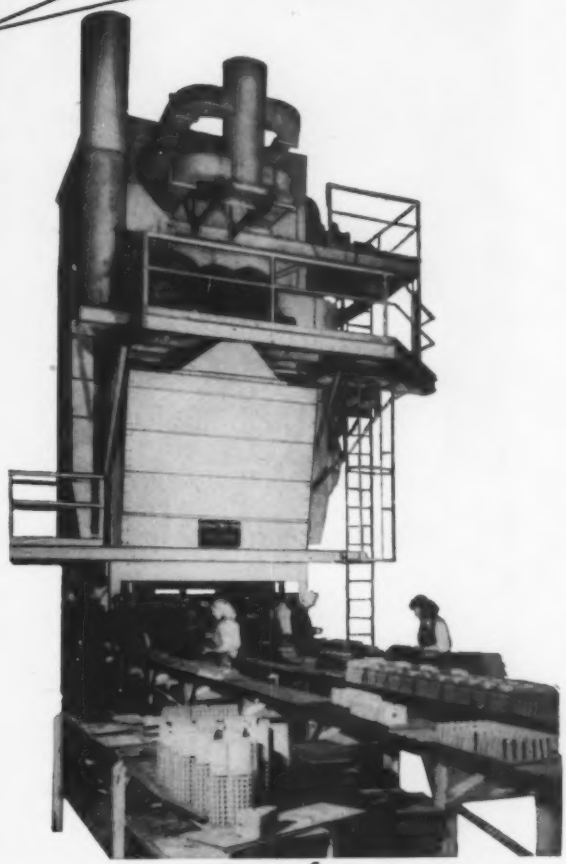
line of Core and Mold Ovens

Every Type.. Every Method

to fit your requirement BEST!



Coleman Car Type Mold Oven



Coleman Tower Oven

Only COLEMAN offers a complete line of foundry ovens with all these advantages

RECIRCULATING HEATING OR DIELECTRIC SYSTEMS to meet your requirement best.

DEPENDABLE BAKING AND DRYING. Coleman Ovens remove all uncertainties in core baking and mold drying. Rejects and make-overs are eliminated.

INCREASED LABOR SAVING. Efficient and modern mechanical designs reduce handling and other indirect labor to a minimum.

HEAVY DUTY CONSTRUCTION. Responsible for dependable performance, economical operation, and minimum maintenance cost under rugged service requirements.

MAXIMUM FUEL ECONOMY. Coleman Heating Systems use the most economical fuel available to you — gas, oil, stoker-coal, electricity, etc.

FLEXIBILITY AND ACCURATE CONTROL to bake oil or resin binders—whichever is most satisfactory for your requirements.

BETTER WORKING CONDITIONS. Positive ventilation built into Coleman Ovens prevents leakage of fumes and gases—helps to make the core department a good place to work.

ADVANCED OVEN "KNOW-HOW". Coleman Engineers have pioneered and developed the most efficient oven designs to meet the highly specialized needs of modern foundry methods in all classes of work.

WIDEST EXPERIENCE. Gained through 50 years of specialization in foundry ovens and the building of more than 11,000 successful Coleman Oven installations.

THE FOUNDRY EQUIPMENT COMPANY

1825 COLUMBUS ROAD • CLEVELAND 13, OHIO

WORLD'S ONLY COMPLETE LINE OF FOUNDRY OVENS

BS&B "PERFECTION" FOUNDRY FLASKS

. . . Are First Choice with THE BULLARD COMPANY!

...Leading Manufacturer of Precision Machine Tools...

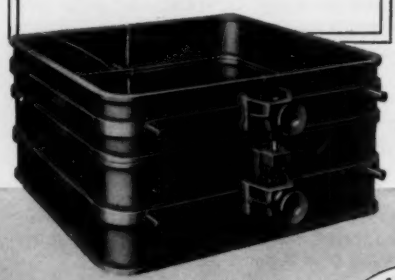
The Bullard Company of Bridgeport, Conn., is known the world over as one of this country's oldest and finest manufacturers of high quality precision machine tools. In their gray iron foundry, which also casts other materials, you'll see row upon row of BS&B "PERFECTION" Foundry Flasks turning out consistently good castings, year in and year out.

Bullard bought their first "PERFECTION" flasks more than 5 years ago, and found them markedly superior in every respect to others they were using. Now, when flasks of any other kind reach the point of replacement, they are replaced with "PERFECTION" flasks exclusively!

Bullard's experience with "PERFECTION" flasks is typical of many of the country's leading foundries . . . Reading Gray Iron Castings, Inc., McNally-Pittsburg, E. L. LeBaron Foundry Co., Westinghouse, Gisholt Machine Co., Prier Brass Mfg. Co., Hartford Electric Steel Co. . . . to mention but a few. These companies know that for every extra penny in cost, "PERFECTION" flasks give many dollars of extra value and service in return.

No Other Foundry Flask Gives You All 4 Features!

1. Continuous welding of bearing strips—inside and out.
2. Cast steel trunions.
3. Cast steel pinlugs and clamplugs.
4. Elimination of corner stresses.



Why not give "PERFECTION" Foundry Flasks a trial in your foundry? Once you *try* them, you'll always *buy* them! Let your BS&B Representative give you the facts.

"PERFECTION" *Flasks*

...Designed By Foundrymen For Foundrymen!

EFFICIENCY · OVER 60 YEARS · BS&B · RELIABILITY

BLACK, SIVALLS & BRYSON, INC.

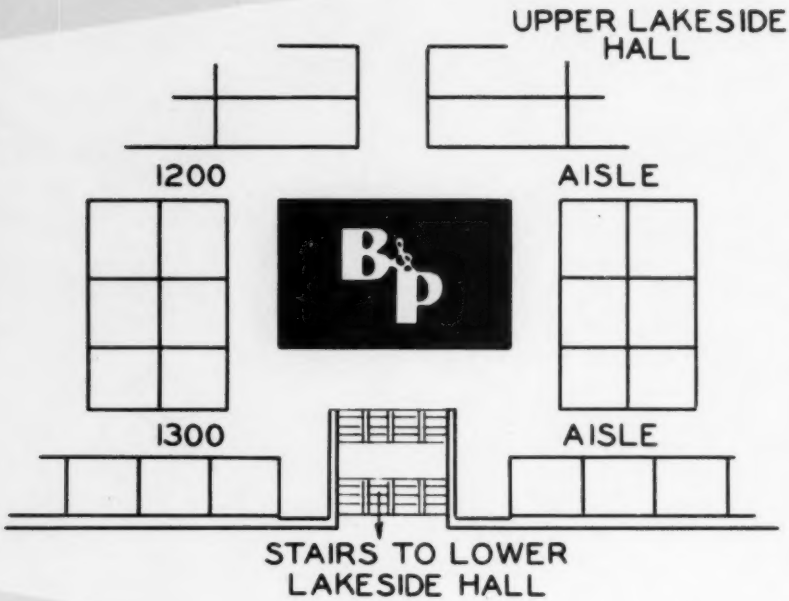
Foundry Flask Division—Dept. 7-AQ5
7500 East 12th Street
Kansas City 26, Missouri

You saw
B&P
"on stage"
at
ATLANTIC CITY

don't miss **BEARDSLEY & PIPER'S**
"PREVIEW OF THINGS TO COME"
at **Cleveland**

BOOTHS 1218 to 1226 and 1327 to 1333

BEARDSLEY & PIPER'S "PREVIEW OF THINGS TO COME"

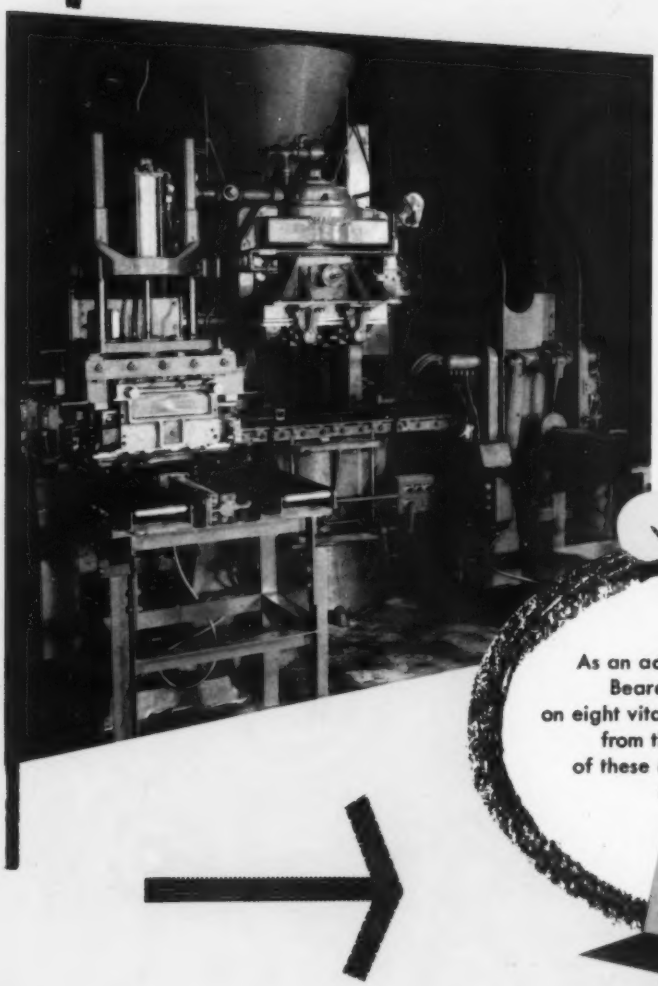


SHELL MOLDING and SHELL BLOWING

For the first time at any exhibit, both shell molding and shell blowing machines will be displayed. If your foundry is now using or contemplating the use of shell molding or shell blowing, this advanced line of machinery will be of vital interest to you. Don't miss it . . . at booths 1218 to 1226 and 1327 to 1333.

GREEN SAND and SHELL MOLDING SAND PREPARATION

The new Special Speedmullor for the preparation of resin coated shell molding sands . . . the unit that cuts resin costs in shell molding by as much as 50%. And—in operation—a Speedmullor-Preparator Unit —the unit that has revolutionized the sand preparation practice of the jobbing foundry. See the latest in sand preparation at booths 1218 to 1226 and 1327 to 1333.



CORE BLOWING and MOLD BLOWING

On display and in operation . . . advanced Champion FLEXIBLO core blowers with new core handling equipment that will set new standards for core production.
For the first time at any foundry show . . . the Champion FLEXIBLO mold blower . . . one of the outstanding machine developments at the 1954 foundry show . . . at booths 1218 to 1226 and 1327 to 1333.

plus

THE B & P MOVIE THEATRE

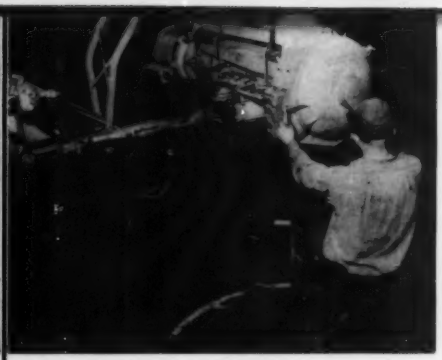
As an added feature at this packed foundry exhibit, Beardsley & Piper will present for the first time, movies on eight vital foundry operations. See modern foundry techniques from the comfort of an arm chair at the B&P booth. All of these movies in sound and a couple in 3D . . . at booths 1218 to 1226 and 1327 to 1333.

LOOK TO
BEARDSLEY & PIPER
FOR BETTER METHODS

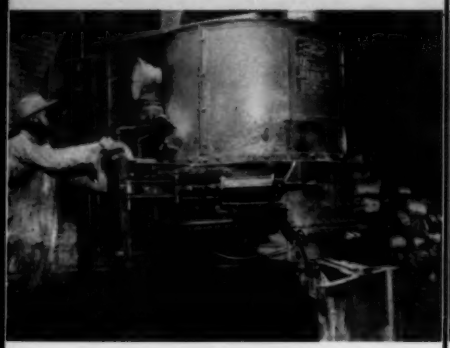
MEMBER FEMA

A Few of the CLEVELAND Area Foundries Depending on B & P Equipment

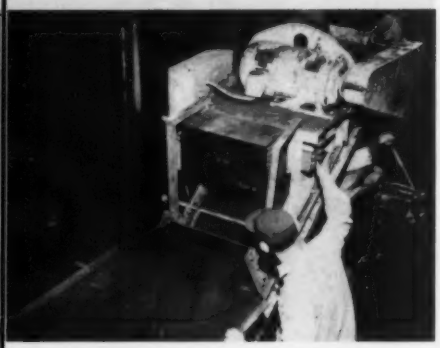
Three of twenty-four Speedmullors that mull all of the molding sand for Ford's new Cleveland foundry.



Head room is only twelve feet, but a Motive Sandslinger handles all of Meech Foundry's work.



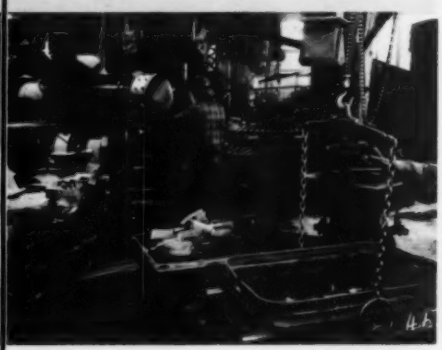
At Ohio Foundry this Model "50" Speedmullor prepares all of the facing sand for side floors.



This Jr. Nite Gang at Kasper Foundry, Elyria, Ohio, does a thorough job on side floor backing sand.

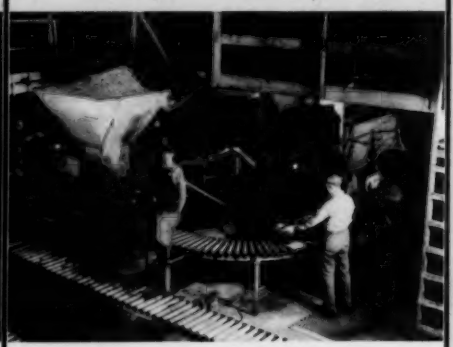
Duplex Foundry obtains the advantages of system sand preparation with this Speedmullor-Preparator Unit.

A Model "40" Speedmullor and a Model 3½ Mulbaro prepare all of the core sand at Harsch Bronze.



This Slinger-Rotomold unit with Champion Speed-Draw Machines handles West Steel's jobbing work.

Large molds are produced in quantity on this J & J 920 RB Rol-A-Draw at Electro Alloys, Elyria, Ohio.



A Champion CB-400 production coreblowing unit blows drawbar cores at American Steel Foundries, Alliance, Ohio.

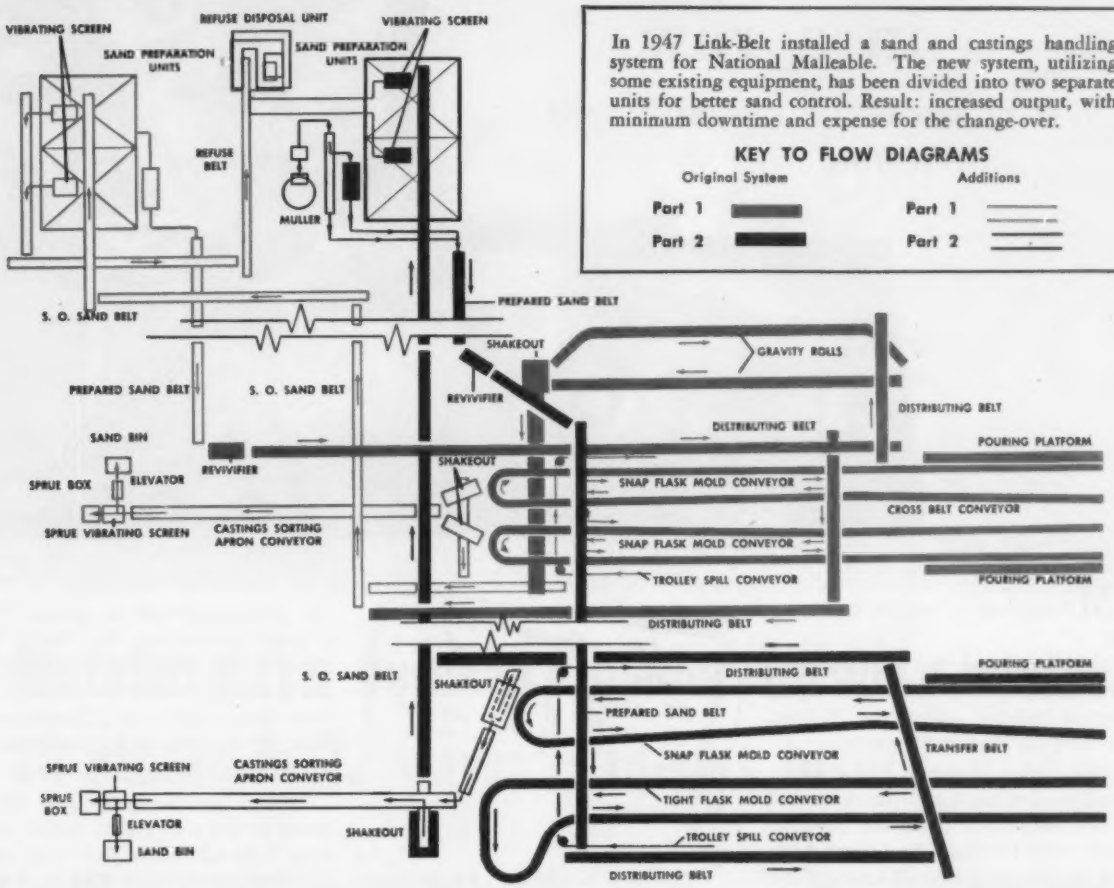
B & P equipment is doing a real job in Cleveland . . . it can do the same in your foundry.

DIV. PETTIBONE MULLIKEN CORP.
2424 N. Cicero Avenue,
Chicago 39, Ill.

SEE OUR EXHIBIT—BOOTH 1422—58th FOUNDRY CONGRESS & SHOW—CLEVELAND, MAY 8-14

When National Malleable & Steel Castings Co. wanted to boost capacity

HERE'S HOW THEY DID IT!



In 1947 Link-Belt installed a sand and castings handling system for National Malleable. The new system, utilizing some existing equipment, has been divided into two separate units for better sand control. Result: increased output, with minimum downtime and expense for the change-over.

KEY TO FLOW DIAGRAMS

Original System		Additions	
Part 1	▬▬	Part 1	═══
Part 2	▬▬	Part 2	═══

And AGAIN--this progressive foundry turned to LINK-BELT

WHEN demand outstripped their Indianapolis facilities, National Malleable and Steel Castings Co. turned to Link-Belt to help increase capacity. As shown in the flowsheets above, the job was complex. In collaboration with National Malleable's engineers, Link-Belt foundry equipment designers tackled this assignment.

More and more foundries have learned to rely on the wide, diversified experience of this company. A Link-Belt foundry engineer will be glad to work with you—suggest ways mechanization can bring you increased output, lower costs, improved quality.

Hooded shakeout (top right) receives molds from cam-type dumper. After cooling on apron conveyor (bottom), castings are sprued. In background: Link-Belt overhead trolley conveyor.

LINK-BELT

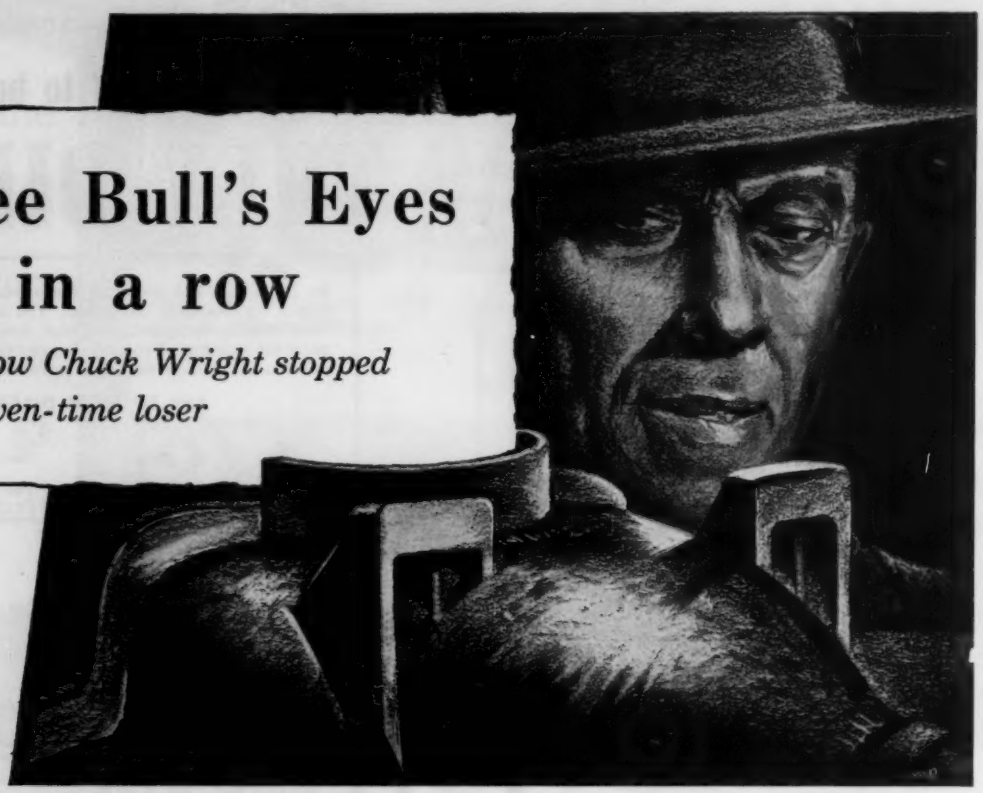
13.425

CONVEYORS and PREPARATION MACHINERY

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

Three Bull's Eyes in a row

...or how Chuck Wright stopped a seven-time loser



"Milmax was in trouble. Bad trouble..."

That's the way the Inco distributor foundry specialist, Chuck Wright, started talking about the Milmax Foundry & Machine Company.

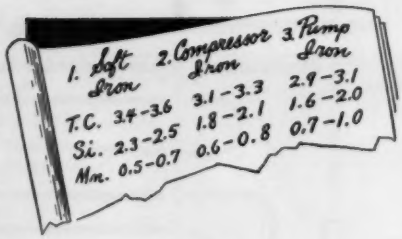
"When I arrived in the district, word reached me that Milmax wanted to see me. Their costs for castings were much too high. So I went down and talked to Clem Morgan, their foundry superintendent.

"His big problem was to produce pressure tight, machinable castings that varied from small compressor units for home air conditioners to pump casings weighing 5 tons.

"Because of this wide variety, Milmax decided to use seven different cupola mixes. As high as five were poured off from just one cupola in one day. Think of the control problem! How the idea of seven cupola mixes got by the Milmax brains department is one of the things I'll die wondering about.

"Everybody was milling around Clem's desk. I really felt sorry for the guy.

"Getting him to one side, I marked his notebook like this...



"Take any single one of these base compositions and you can get three different types of iron by treating it with suitable additions of nickel plus chromium or molybdenum. Clem was mighty glad to learn three base compositions... with alloy additions... could answer all his needs.

"He uses No. 1 for light section work, adding 0.75 to 1% nickel for tightness and machinability in pressure castings.

"His big tonnage iron, No. 2, is brought down through the cupola with 0.75 to 1% nickel, to reduce the amount of alloy additions to the ladle. Practically all is poured with silicon inoculation. You know, the greater the pressure requirements the greater the need for nickel. Clem increases nickel up to 2% maximum. And for density in sections close to 2", he adds 0.25 to 0.40% chromium.

"No. 3, the pump iron, he brings down with 1.0 to 1.25% nickel to reduce ladle additions. But in all cases it's inoculated with 0.25 to 0.40% silicon, because pumps face high pressures that call for heavy sections in flanges and in other critical areas.

"For higher pressure needs, Clem raises the nickel to 1.75%. For castings with the heaviest sections, he uses additions to the base iron of 0.25 to 0.50% Cr and 0.20 to 0.40% Mo, with nickel at 1.5 to 1.75%. By raising the nickel of the base iron to about 2.5% and adding 0.6 to 1% Mo, plus ladle inoculation of 0.5% Si, he makes a high test gray iron of 60,000 psi. minimum.

"It's surprising how many foundry troubles can be eliminated through the use of nickel. Whenever you face a casting problem, just drop me a line. I'll be happy to give you some practical help."

Chuck Wright

The International Nickel Company, Inc.

67 Wall Street New York 5, N. Y.

Larry Emery, Chief Metallurgist, Marion Malleable Iron Works, in the laboratory where he developed his revolutionary new core binder formula last year.

Metallurgist's new core binder formula beats all others in 22 ways . . . thanks to PLASKON®

ALKYD RESIN

Marion Malleable Iron Works — makers of heavy castings for the railway and automotive industries —was having its full share of foundry headaches around this time last year. Heavy castings were showing cracks and tears. Binder waste, as well as casting losses, was uneconomically high. Employees complained that binder material being used had a sickening odor and irritated the skin.

Then Chief Metallurgist Larry Emery went to work—experimenting with a small order of PLASKON 580-11L Alkyd Synthetic Core Binder. Result: a core binder superior to all others ever used by Marion Malleable—in these 22 different ways—

1. Indefinite storage life 2. More uniform mix 3. No expensive release agents required 4. No skin irritations or objectionable odors 5. Lengthy air-drying has no effect on core quality 6. Cores do not need to be fogged 7. Baking time reduced 50% 8. Finer sands can be used 9. Overbaking does not affect cores 10. Moisture content of sand mix not a critical factor 11. Higher dimensional stability 12. Casting finish comparable to shell cores 13. Veining, rat-tails minimized 14. Lower resin-to-sand ratio 15. Elimination of wires in cores 16. Higher tensile and transverse strength 17. Less core breakage 18. Excellent collapsibility, fewer core butts 19. Uniform gas-evolution rate 20. Bentonites can be used with no strength loss 21. Sand can be reclaimed 22. Less binder needed.

Interested in Larry Emery's core binder formula? We'll be glad to supply it on written request. Also available without obligation, your PLASKON man's technical assistance and research facilities for the most efficient use of PLASKON products for industry.

INVITATION

You are cordially invited to visit the Plaskon products exhibit in Booth 1909 at the 58th Annual Foundry Congress and Show, Cleveland, May 8 to 14.

Barrett PLASKON

For further information on PLASKON plastics and resins contact Barrett Division, Allied Chemical & Dye Corporation, 40 Rector Street, New York 6, N. Y. Whitehall 4-0800

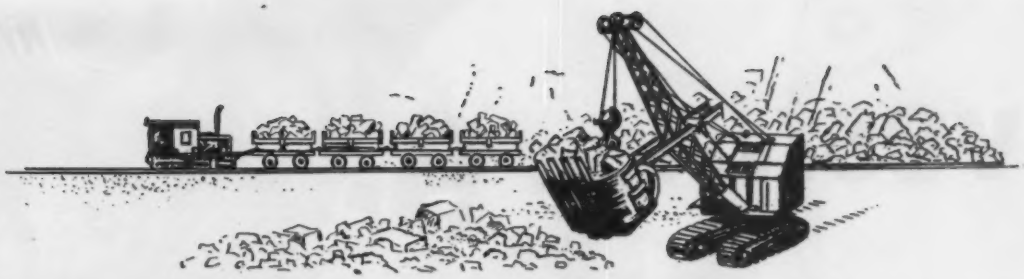
Allied Chemical

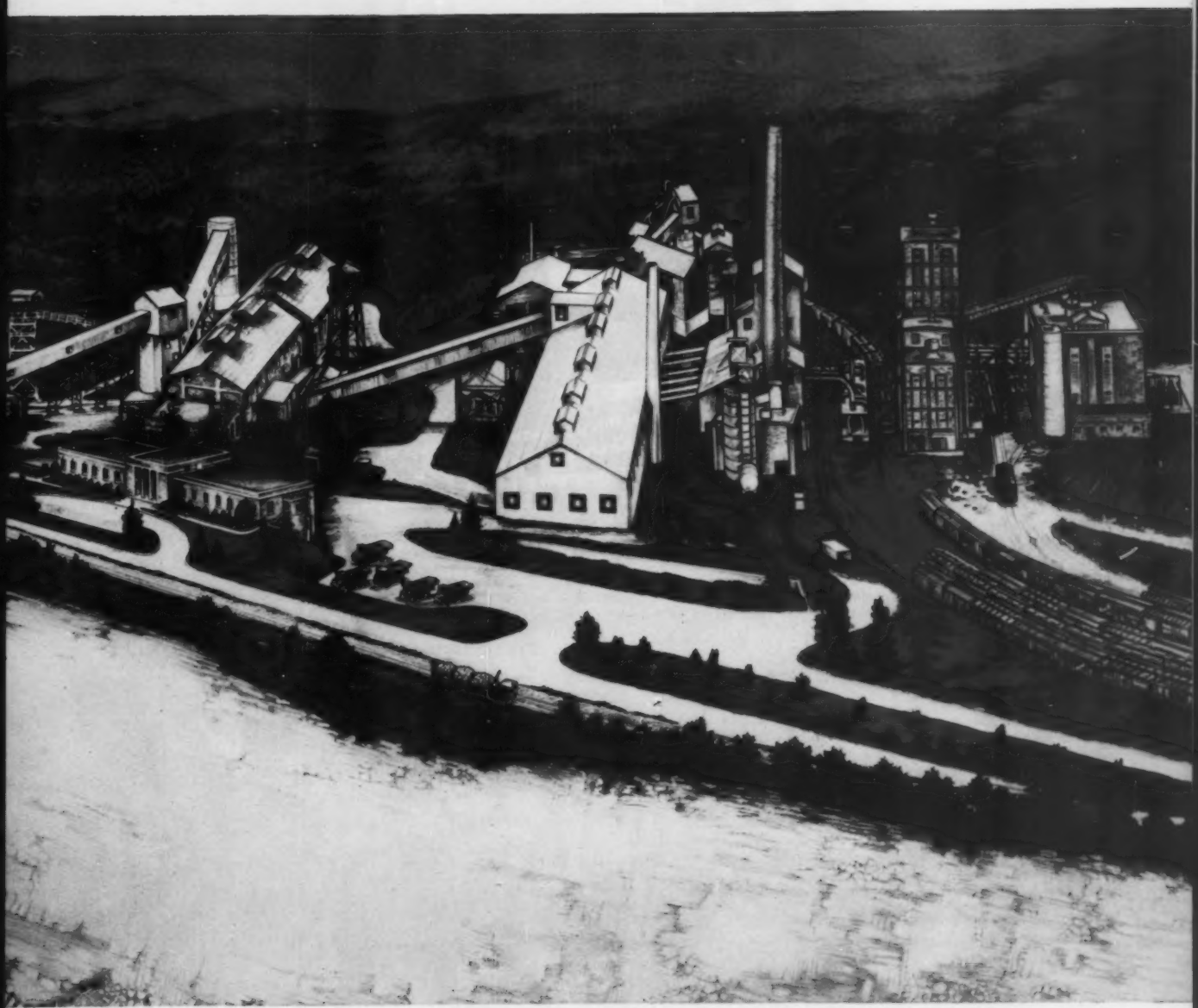
Designed and Equipped

to Produce...

Quality Foundry Sands

- MOLDING SAND
- CORE SAND
- SANDBLAST SAND
- SHELL-MOLDING SAND
- SILICA FLOUR





PENN-SAND

THE SURE START TO A PERFECT FINISH

© 1954 Pennsylvania Glass Sand Corp.

PENNSYLVANIA GLASS SAND CORPORATION
Two Gateway Center, Pittsburgh, Pa.

Please send me further information and sample of each PENN-SAND product checked below.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

☐ Molding Sand ☐ Core Sand ☐ Sandblast Sand
☐ Shell-Molding Sand ☐ Silica Flour

Invest... in A.F.S. Membership

Exhibits at biennial A.F.S. Foundry Show enable Members to inspect latest foundry equipment and supplies.

... if you are looking for profitable and lasting friendships in the foundry industry

... if you recognize the value of being well-informed on the latest foundry techniques and applications

... if you want access to a constant source of help relating to casting and operational problems

... if you want to be an integral part of a group of progressive foundrymen who freely contribute to an exchange of knowledge and experience for personal advancement and industry progress

Membership in A.F.S. . . .

represents an investment in an essential industry . . . actually, job insurance . . . because, through Society service and Society contacts, you endow yourself with a technical knowledge leading to self-development and a better job as an informed employee.

Committee Activities . . .

Over 500 Members serve voluntarily on the many committees of A.F.S. and its Chapters, finding in these activities and associations a worthwhile opportunity to advance themselves, their firms and the industry they represent. A.F.S. welcomes members to Committee Service.

A.F.S. Publications . . .

The dissemination of authoritative information leading to better foundry practice—in other words, better castings through simplified production procedures at minimum cost—and products is another primary function of the American Foundrymen's Society. In line with this thinking, Society publications are constantly developed through A.F.S. Committee projects. Members enjoy special discounts on all book purchases.

American Foundryman . . .

Announcements and reports of all A.F.S. activities regularly appear in AMERICAN FOUNDRYMAN—membership service includes a monthly copy of this technical-practical magazine which is published to assist the American Foundrymen's Society in keeping the industry progressive, so that all branches of the metal castings field can compete with modern thinking in research, design, engineering and production.

Chapter meetings, regional conferences and National Conventions promote friendships . . . invite exchange of ideas.

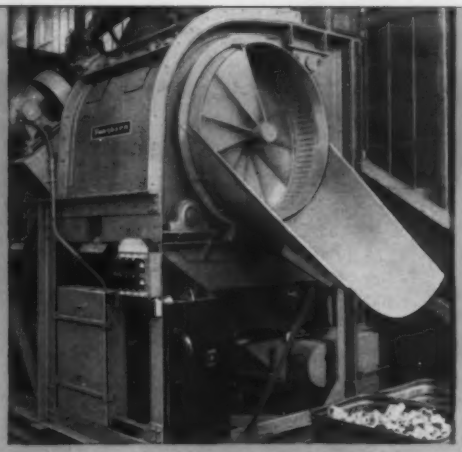
Authorities in modern foundry practice regularly present the latest information for the benefit of A.F.S. Members.

Recognition of outstanding service and encouragement of youth activities build a stronger, more unified industry.

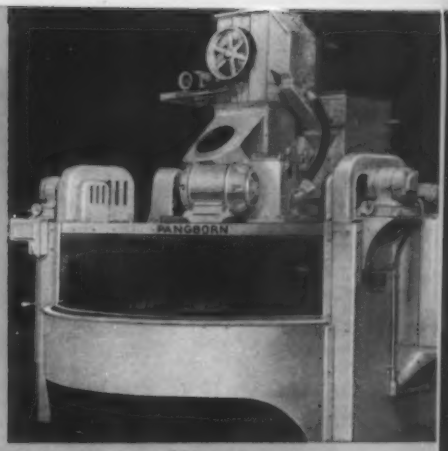
AMERICAN FOUNDRYMEN'S SOCIETY

616 South Michigan Avenue, Chicago 5, Illinois

Pangborn Blastmaster® Barrels for top efficiency in batch cleaning. Newest addition to Pangborn line, features abrasive-tight door and automatic throw-out torque arm.



Pangborn Continuous-Flo ROTOBLAST Barrels for cleaning steady flow of miscellaneous work quickly. Operated by one man on production line basis.



Pangborn ROTOBLAST® Tables for semi-continuous blast cleaning. Types and sizes for castings of all sizes, surfaces, intricate shapes, and pockets.

Pangborn's 50 years of progress

offer you a complete line of equipment for every blast cleaning and dust control need

Fifty years of know-how . . . a half-century of research and development . . . and today Pangborn Blast Cleaning and Dust Control Equipment promises *and delivers* better, faster, cheaper performance on any foundry job. Shown here are just a few machines from Pangborn's *complete line* of equipment.

Pangborn engineers and equipment can save *you* time, labor, and money. Our engineers will be happy to work closely with you, in recommending the exact Pangborn unit you need, and in developing new equipment when necessary. No matter what you clean —large or small castings, ferrous or non-ferrous work . . . or whatever dust problem you have, it will pay you to find out how Pangborn can help you.

Send for the Pangborn bulletins that fit your needs. Write: PANGBORN CORPORATION, 1300 Pangborn Blvd., Hagerstown, Md.

50th ANNIVERSARY

Pangborn CORPORATION

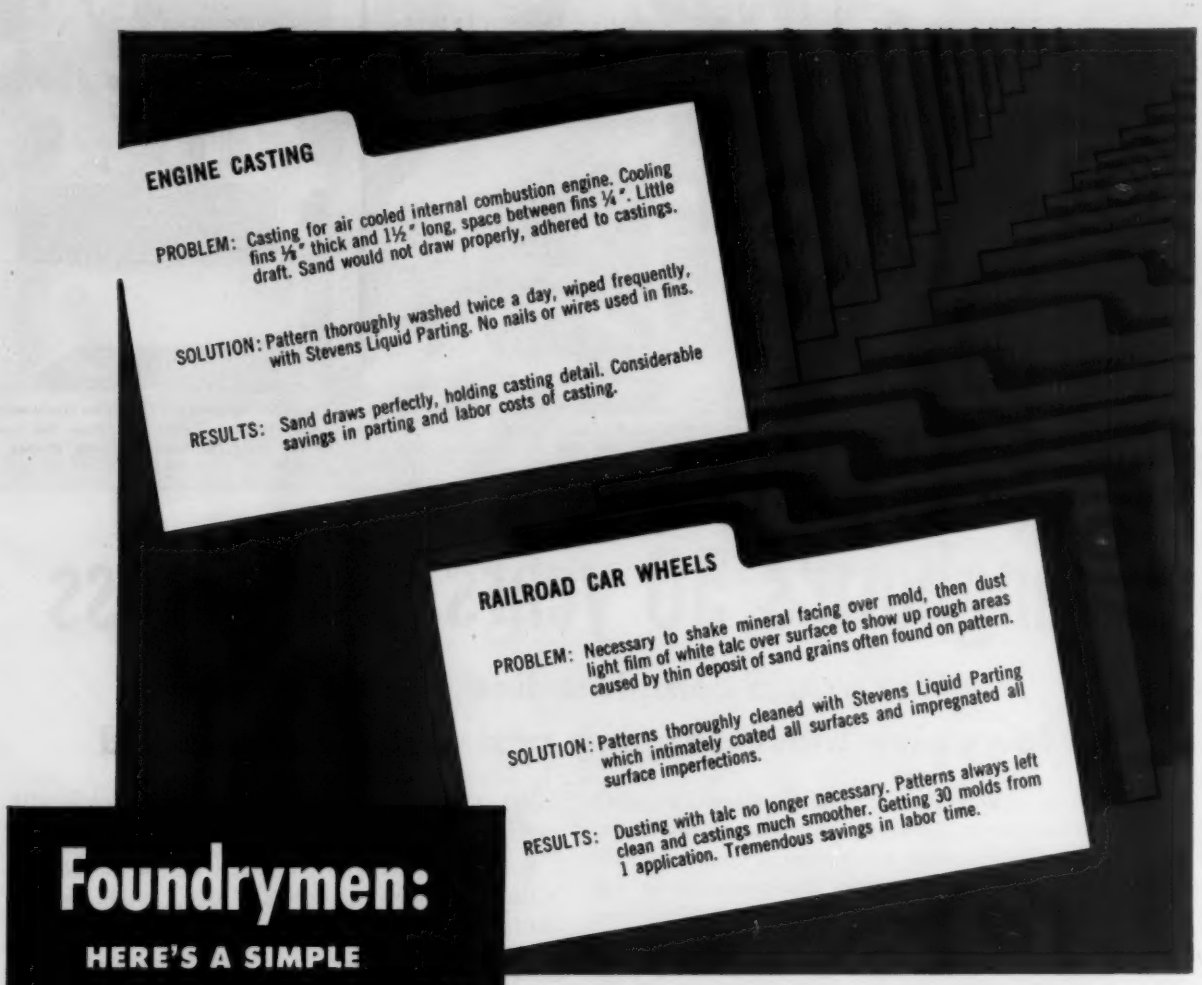
1904-1954

Visit Pangborn's booth #1415—1417, Lower Exhibition Hall, at the Foundry Show.

Pangborn ROTOBLAST Table-Rooms clean castings from a few pounds to 2½ tons. Extremely efficient for jobbing foundries. Perfect for all-purpose blast cleaning.

Pangborn Airless ROTOBLAST Rooms for general blast cleaning of extra-large and miscellaneous castings. Operated from outside.

Pangborn Dust Control Equipment to reduce housekeeping costs, minimize dust damage to machinery, improve employee morale and community relations. For any size requirement.


ENGINE CASTING
PROBLEM: Casting for air cooled internal combustion engine. Cooling fins ⅛" thick and 1½" long, space between fins ¼". Little draft. Sand would not draw properly, adhered to castings.
SOLUTION: Pattern thoroughly washed twice a day, wiped frequently, with Stevens Liquid Parting. No nails or wires used in fins.
RESULTS: Sand draws perfectly, holding casting detail. Considerable savings in parting and labor costs of casting.
RAILROAD CAR WHEELS
PROBLEM: Necessary to shake mineral facing over mold, then dust light film of white talc over surface to show up rough areas caused by thin deposit of sand grains often found on pattern.
SOLUTION: Patterns thoroughly cleaned with Stevens Liquid Parting which intimately coated all surfaces and impregnated all surface imperfections.
RESULTS: Dusting with talc no longer necessary. Patterns always left clean and castings much smoother. Getting 30 molds from 1 application. Tremendous savings in labor time.

Foundrymen:

HERE'S A SIMPLE FORMULA FOR CUTTING MOLDING COSTS!

1 good parting = 6 good savings

Many foundries, such as those above, prefer Stevens Liquid Parting because it solves "hard-to-solve" molding problems. But its day by day economy in normal molding operations has played an even greater part in making it *the world's largest selling liquid parting.* Here's how Stevens Liquid Parting saves money for you every day:

1. Gives up to 60 molds per application . . . saves hours of molder's time.
2. Keeps patterns and core boxes completely free of adhering sand.
3. Thoroughly cleans, prevents rust on metal plates, patterns, etc.
4. Eliminates any need for heating patterns or plates.
5. Eliminates inhalation of dry parting dust, improving efficiency.
6. Eliminates sand adherence on sand hoppers, shovels and other sand-handling equipment.

Put the Stevens Liquid Parting formula for savings to the test. Apply it to your molding operation. Call your Stevens Representative for a sample today. Or write direct to FREDERIC B. STEVENS, INC., Detroit 16, Michigan.

Visit our Exhibit at the AFS Foundry Congress and Show in Cleveland, May 8-14

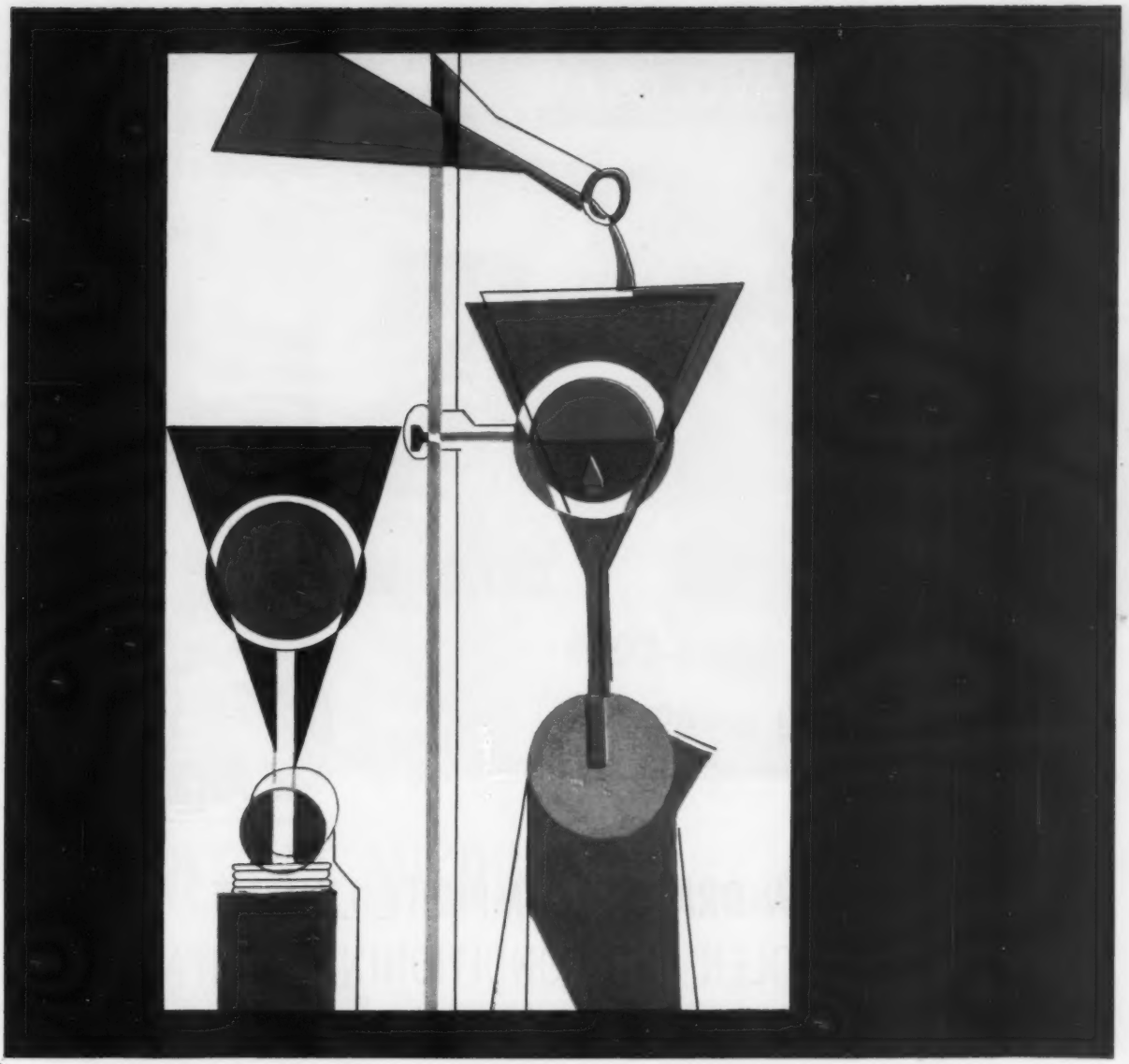
Exclusive sales agents for Sutter foundry equipment in the United States. See the Sutter Products advertisement on pages 55-58.

BRANCHES: **BUFFALO • CLEVELAND • INDIANAPOLIS NEW HAVEN • DAYTON**

IN CANADA: **FREDERIC B. STEVENS OF CANADA, LTD., TORONTO • WINDSOR**

STEVENS

EVERYTHING FOR A FOUNDRY



In making a casting specify PENOLYN CORE OIL

for assured high efficiency

- Uniformity
- Concentrated form
- No obnoxious odor
- No seepage
- No crusting or green mix
- Clean working
- Wide temperature range
- Polymerized formulation
- Minimum gas
- Ample collapsibility

FOR MAXIMUM FOUNDRY EFFICIENCY—always be sure to specify PENOLYN CORE OIL. There's a grade of Penolyn to meet the most exacting requirements of every Foundry and Core Room Practice.

FOR EXPERT TECHNICAL ASSISTANCE—always be sure to call the Penola Office nearest to you for any technical data or assistance regarding *your* casting operations.

Penola

We welcome you
to the Penola Booth 908
American Foundrymens Society Congress
May 8th—14th, Cleveland, Ohio

PENOLA OIL COMPANY

NEW YORK · DETROIT · CHICAGO

Penola

DRAVO CRANE CAB COOLERS

SEE HOW **DRAVO'S** COMPLETE LINE OF CRANE CAB COOLER AND CONDITIONING EQUIPMENT CAN IMPROVE YOUR FOUNDRY OPERATIONS

You'll learn . . .

—how Dravo cooling and conditioning equipment improves the productivity of your overhead cranes . . . makes crane operators more alert and efficient . . . reduces crane down time.

—that Dravo equipment can handle any conditioning or cooling problem where fumes, sand, dust, dirt or intense heat create an unhealthy atmosphere for crane operators.

You'll see . . .

—the Dravo Self-Contained Crane Cab Cooler for installation on the crane cab roof or alongside the cab.

—the Dravo Split-Type Crane Cab Cooler for installation in two sections where space limitations exclude a self-contained unit.

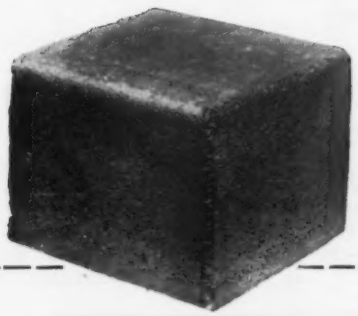
—various models of the Dravo Conditioners to install inside the cab for heating and ventilating.

Take time . . .

—to visit the Dravo Exhibit at Booth 2004-2006 *in the Arena*. You'll be glad you did!

DRAVO
CORPORATION
PITTSBURGH, PENNA.
Sales Representatives in Principal Cities

REDUCE MISRUNS by as much as 50%



Iron deoxidized with FERROCARBO® patented Briquettes is *more fluid* at casting temperatures than untreated iron. It flows more readily into thin sections or complicated molds. You get better castings...fewer misruns. Leading foundries report up to 50% reduction in misruns after using FERROCARBO in the charge.

Deoxidizing with FERROCARBO gives you additional advantages, too: Silicon recovery increases materially. You can charge more scrap—either steel or cast iron—since FERROCARBO reduces the chilling tendency.

The man who uses your castings benefits, too. The castings you supply him are finer-grained, denser, stronger...much easier to machine because they contain fewer segregations and chilled or hard spots.

FOR ALL THE FACTS, call your FERROCARBO Distributor today. Or write for the free booklet, "Producing Superior Gray Iron Castings." Address: The Carborundum Company, Dept. AF 84-41, Niagara Falls, N.Y.

FERROCARBO DISTRIBUTORS:

KERCHNER, MARSHALL & CO.
PITTSBURGH • Cleveland • Buffalo
Philadelphia • Birmingham • Los Angeles

MILLER & COMPANY
CHICAGO • St. Louis • Cincinnati

WILLIAMS & WILSON
TORONTO • Montreal • Windsor

● In Canada, "Carborundum" and "Ferrocarbo" are registered trademarks of Canadian Carborundum Company, Ltd., Niagara Falls, Ontario

FERROCARBO
REGISTERED TRADE MARK

by CARBORUNDUM
REGISTERED TRADE MARK

84-41

STRATEGIC LOCATIONS
of Semet-Solvay's Coke Plants and Coal Mines

1 2 3 • • •

SECURITY OF SUPPLY

Semet-Solvay Division is the only merchant coke producer with four coke plants. Our 701 coke ovens . . . our recent expansion . . . our new, tremendous rated capacity of 3,750,000 tons of coke a year means that you can depend on Semet-Solvay for *all* the foundry coke you need.

BETTER SERVICE

You can't beat the dependable service readily available from a Company which not only has a plant near you, but also has plants on the edge of the best by-product coal field in the world. Look at the map on the opposite page . . . See why Semet-Solvay can serve 82% of the gray iron foundries in the U. S. and Canada conveniently and economically from one or more of its plants. Strategic locations does it!

BETTER COKE

Semet-Solvay Foundry Coke is famous for its closely controlled quality . . . for, from the selection and cleaning of special coking coals from our own mines to the screening and loading of high-quality, uniformly sized foundry coke, every operation is under strict Semet-Solvay control.

FREE METALLURGICAL SERVICE

Trouble or variable results in a foundry can very often be quickly diagnosed by an outside consultant. That's why Semet-Solvay has a staff of experienced foundry metallurgists. These men are practical foundrymen, and they are at your service — without obligation — for just a call to our nearest sales office.

BUFFALO
602 Genesee Building
Buffalo 2, New York

CINCINNATI
723 Dixie Terminal Building
Cincinnati 2, Ohio

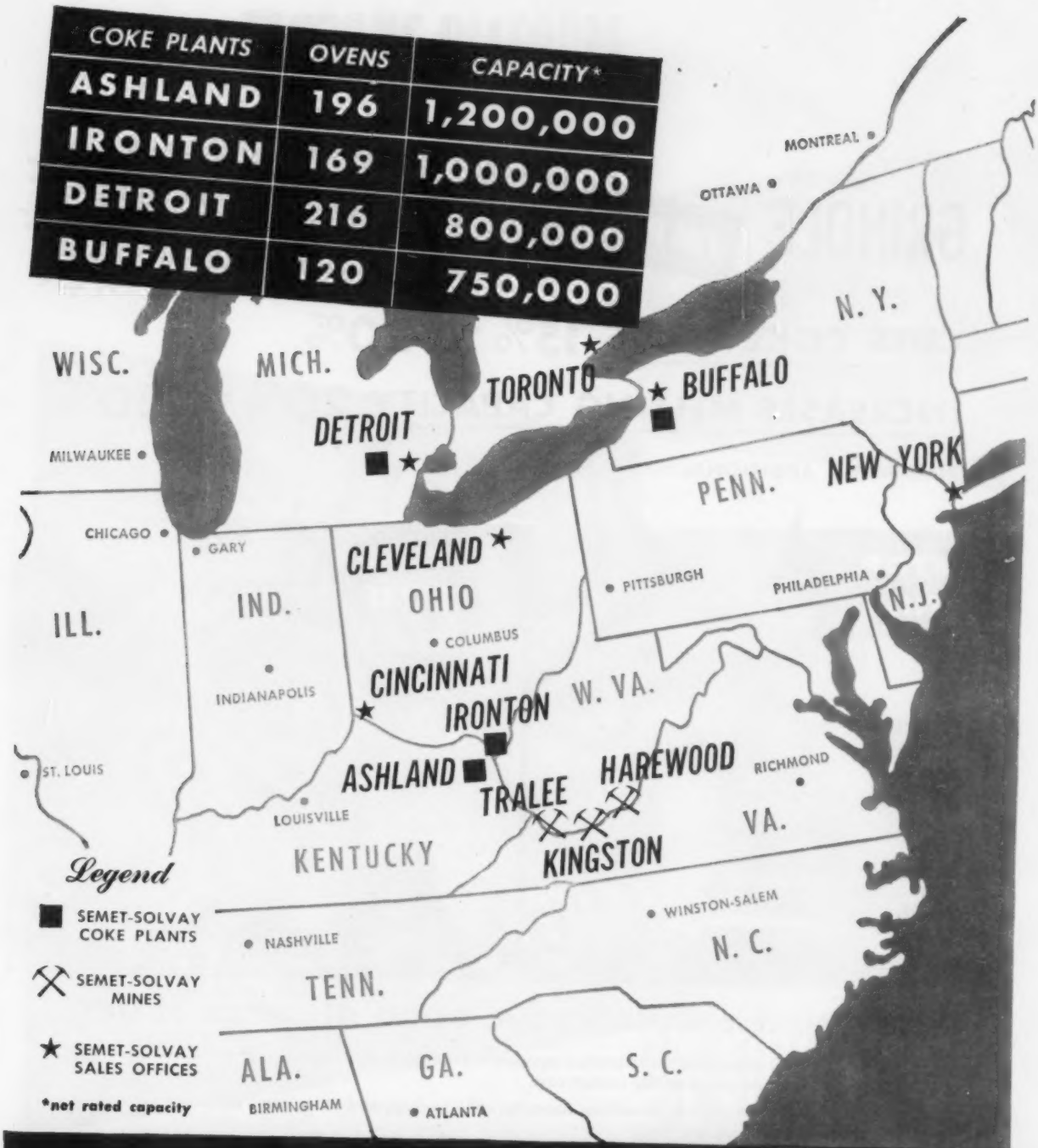
CLEVELAND
2405 Terminal Tower Building
Cleveland 13, Ohio

DETROIT
2532 Buhl Building
Detroit 26, Michigan

TORONTO
1317 Canadian Bank of Commerce Building
Toronto 1, Ontario, Canada

A Better America Through Chemical Progress

CHEMICAL PROGRESS WEEK-MAY 1972



SEMET-SOLVAY DIVISION

Allied Chemical

GRINDLE IMPROVED HOT BLAST

CUTS COKE COSTS 15% TO 20%

INCREASES MELTING CAPACITY 20% TO 30%

PLUS MANY ADDITIONAL SAVINGS

LET GRINDLE ENGINEER YOUR GOOD NEIGHBOR POLICY

- **Let us provide the improved equipment required to produce the highest grade metal at the lowest cost.**
- **Proven increased melting capacity, coke savings and other items will soon pay the cost.**
- **The addition of Grindle stack gas purifying equipment clears up a public nuisance.**

CUPOLAS • BLOWERS • CHARGING EQUIPMENT • SPARK ARRESTERS
HOLDING FURNACES • LADLES • INSTRUMENTATION • ANNEALING
OVENS • SCALE AND TRANSFER CARS • ENGINEERING SERVICES

WRITE FOR ADDITIONAL INFORMATION

MEMBER FEMA

GRINDLE CORP. 16237 TURNER AVE. • HARVEY, ILLINOIS

Grindle

Visit us at our booths — No. 1106 and No. 1108.

TACCONE DIAFORM MOLDING MACHINE

makes available now to every foundry

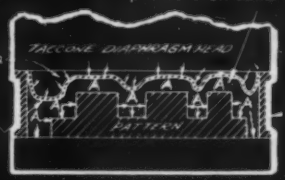
- ☆ High Pressure Molding
- ☆ High Speed Operation
- ☆ Low Machine and Pattern Equipment Maintenance

TACCONE PRINCIPLE

Pressure surface of diaphragm on sand is approx. 40% greater than the area of the flask

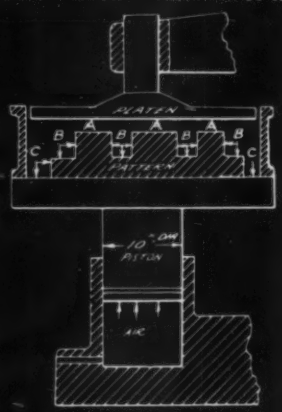
Flask size = 12" x 18"
Area = 216 sq. in.
216 + 40% = 302 sq. in.
302 sq. in. x 80# line pressure = 24,160#

24,160 pounds total pressure on sand



A—DENSITY OF RAM ESSENTIALLY IDENTICAL AT ALL POINTS

80 LB. LINE PRESSURE



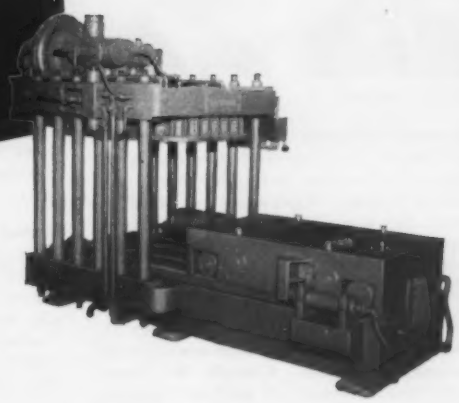
CONVENTIONAL SQUEEZE

A—HARD RAM
B—MEDIUM RAM
C—SOFT RAM

6,280 pounds total pressure on sand

Area of 10" dia squeeze piston = 78.5 sq. inches. 78.5 x 80# line pressure = 6,280#

HIGH PRESSURE MOLDING
PRECISION CASTINGS
LOWER PATTERN COST
FASTER MOLDING
LESS FLASK MAINTENANCE
MOLD HARDNESS CONTROL
UNIFORM MOLD HARDNESS
LOWER COST MOLDING
LESS AIR CONSUMPTION



Write for new folder
"Taccone Diaform Molding Machine"

Minerals International Chemicals

EASTERN CLAY PRODUCTS DEPT.

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

General Offices: 20 North Wacker Drive, Chicago, 6

DIXIE BOND • BLACK HILLS BENTONITE • TRIPLACT • REVIVO CORE PASTE • REVIVO BOND • BONDACTOR • CUPOLINE • DURA PRODUCTS • WESTONITE

Foundrymen in the News

Lynchburg (Va.) Foundry Co. has elected three new directors, a vice-president, and a general manager. New members of the board are **Paul E. Sackett, Charles W. McLennan,** and **Lloyd C. McNeill.** The other eight board members were re-elected. In order to fill vacancies caused by the death last July of Max Kuniansky, Mr. McLennan was elected vice-president, and Mr. McNeill general manager. Officers re-elected were **Henry E. McWane,** president; **C. R. Spencer,** vice-president; **I. M. Lynn,** treasurer; **R. S. Shelton,** secretary and assistant treasurer; and **J. B. Evans,** assistant secretary.

Theodore E. Burke, formerly manager, foundry coke sales, Great Lakes Carbon Corp., St. Louis, is now vice-president in charge of sales, Mid-Continent Coal & Coke Co., Chicago.

L. J. Shorek

K. W. Jones

A. A. Conrad, Jr.

E. S. Ogden

Leonard J. Shorek has joined the Fred W. Fuller Co., Cleveland, as sales representative handling industrial ovens and allied foundry equipment in northern Ohio. He is a graduate of Detroit Institute of Technology and for the past five years has been chief engineer, Young Bros. Oven Co., Cleveland.

Foundry sales division, Frederic B. Stevens, Inc., Detroit, announces several personnel changes. **Kenneth W. Jones** will cover Connecticut and northeastern New York. He comes from Fafnir Ball Bearing Co., New Britain, Conn. **Albert J. "Bud" Welch,** formerly with Cascade Foundry Co., Erie, Pa., will have the southwestern Pennsylvania territory. Parts of eastern Michigan and Wayne County will be handled by **Sidney J. Tuson,** who has 25 years of foundry experience. **Nick Popa** has been appointed as special equipment sales engineer, specializing in the Sutter foundry equipment line. He has been a design engineer with Sutter Prods. Co. for seven years. **Edwin Stanley Ogden** is now sales representative for the complete line of Stevens metal finishing supplies and equipment.

H. W. Dietert

D. L. Buss

H. W. Dietert Co., Detroit, has elected **Harry W. Dietert** as chairman of the board, in which office he will have more time to devote to developments pertaining to the foundry industry. **D. L. Buss** was named president of the firm; **F. E. Brewster** vice-president; and **Jess Toth** secretary and sales manager.

James D. Voss has been appointed chief metallurgist, Hamilton (Ohio) Foundry & Machine Co. He will be in charge of

L. W. Olsen, Jr.

J. D. Voss

all melting, sand preparation, and laboratory operations. Mr. Voss was an F.E.F. co-op student at University of Cincinnati, graduating in 1950.

Louis W. Olsen, Jr. has been appointed purchasing agent, Grindle Corp., Harvey, Ill.

Arthur A. Conrad, Jr. has joined the Detroit technical section of International Nickel Company's development and research division. A metallurgical engineering graduate of Carnegie Institute of Technology, Mr. Conrad formerly was chief metallurgist, Precision Metalsmiths, Inc., Cleveland.

W. S. Pellini, formerly head, Metal Processing branch, Division of Metallurgy, Naval Research Laboratory, has been promoted to superintendent of the division. The research and development program includes foundry, welding, physical metallurgy, high temperature alloys, titanium, and metal corrosion.

John Taylor, a vice-president of Lester B. Knight & Associates, Chicago for 3½ years, has become a directing associate, Griffenhagen & Associates, Chicago.

James L. Goodwin has been appointed Cleveland district manager, Sterling Abrasives Div., Cleveland Quarries Co. He has been a sales engineer for the company for 19 years.

Robert A. Stauffer and **Kenneth G. Donald** have been elected to the board of directors, National Research Corp., Cambridge, Mass. Mr. Stauffer has been vice-president and director of research of the organization since 1949. Mr. Donald has been vice-president and treasurer since 1953. Both were educated at Harvard.

Richard E. Farrell has joined the sales force of Vesuvius Crucible Co. and will cover the Philadelphia district.

Carl Van Buren, 27-year employee and formerly superintendent, brass foundry, Allis-Chalmers Mfg. Co., West Allis, Wis., is now with Milward Alloys, Inc., Lockport, N. Y. He will represent the company in Wisconsin, Chicago and northern Illinois, western Michigan, and the Minnesota Twin-City area.

Morris G. McQuiggan has joined the foundry coke sales division of LaSalle Coke Co., Montreal, Que., Can. Associated with the industry for 18 years as molder, foreman, foundry superintendent, and supply salesman, he is a director of Eastern Canada Chapter of AFS.

Electro Refractories & Abrasive Corp., Buffalo, N. Y., has promoted **R. Clyde Wolfgang** from general sales manager to vice-president in charge of sales. **George B. Michie,** a vice-president since 1945, is now director of public relations. Mr. Wolfgang will assume supervision of all domestic and foreign outlets while retaining his duties as general sales manager. Michie will plan and develop programs for new products and direct the preparation of direct mail material, convention exhibits, and company publications.

Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., has made several top-level changes. **Joseph M. Schaeffer** was elected president by the board of directors. **Richard L. Wilcox,** former president, was named chairman of the board to succeed **David C. Griggs,** retiring as chairman. Vice-presidents re-elected were: **Fred S. Van Valkenburg** and **Irving H. Tolles. Richard C. Bannon** was newly elected as a vice-president. **A. Dale Mitchell** was selected as treasurer, succeeding **Lewis S. Reed,** who retired.

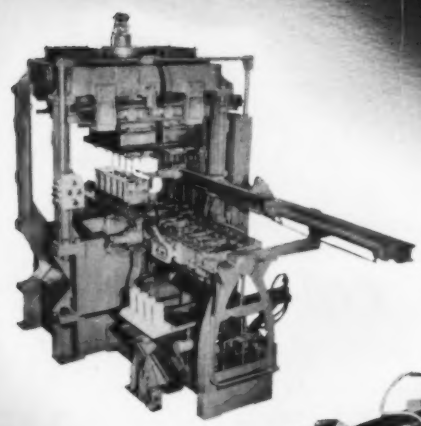
A. A. Dobbs has been made vice-president-foundry at Virginia Metalcrafters, Waynesboro, Va. He has been foundry superintendent at the plant since 1947.

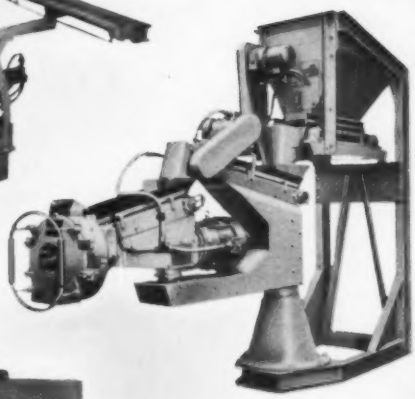
Richard McLean has been named foundry superintendent at City Pattern Foundry & Machine Co., Detroit. **Frank Heffner,** 20-year employee, has been made purchasing agent; and **Joseph C. Nuttall** is now in charge of the shipping department.

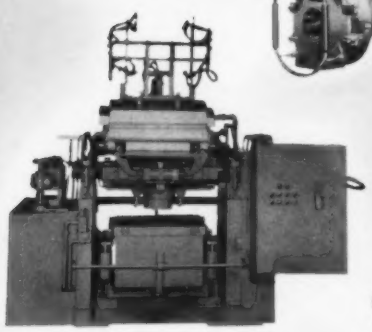
continued on page 59

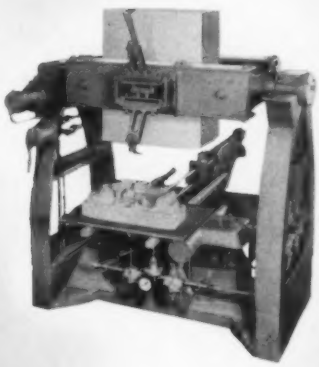
SUTTER

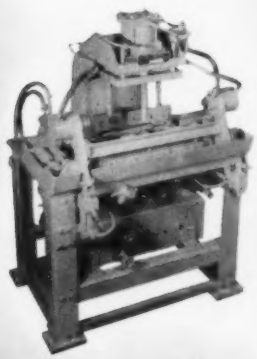
advanced design foundry equipment . . .

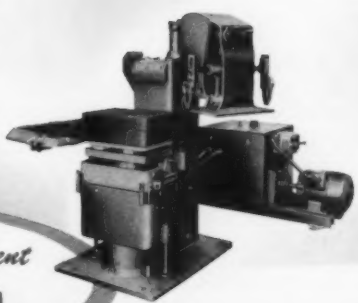












Is your foundry production in step with today's pace—are you meeting today's rigid dimensional requirements—do time studies show you are attaining maximum efficiency? If the answer is "no" to any of these questions, it will pay you to check the features and advantages of Sutter foundry equipment on the next three pages.

Sutter equipment is now in foundries all over the world . . . increasing production, improving quality and providing outstanding economy. It can do the same for you.

See Sutter Equipment

IN OPERATION

FOUNDRY SHOW—*Booths 1310-1316*

SUTTER

PRODUCTS COMPANY

2005 WESTWOOD AVE. • DEARBORN, MICH.

INCREASE CORE PRODUCTION

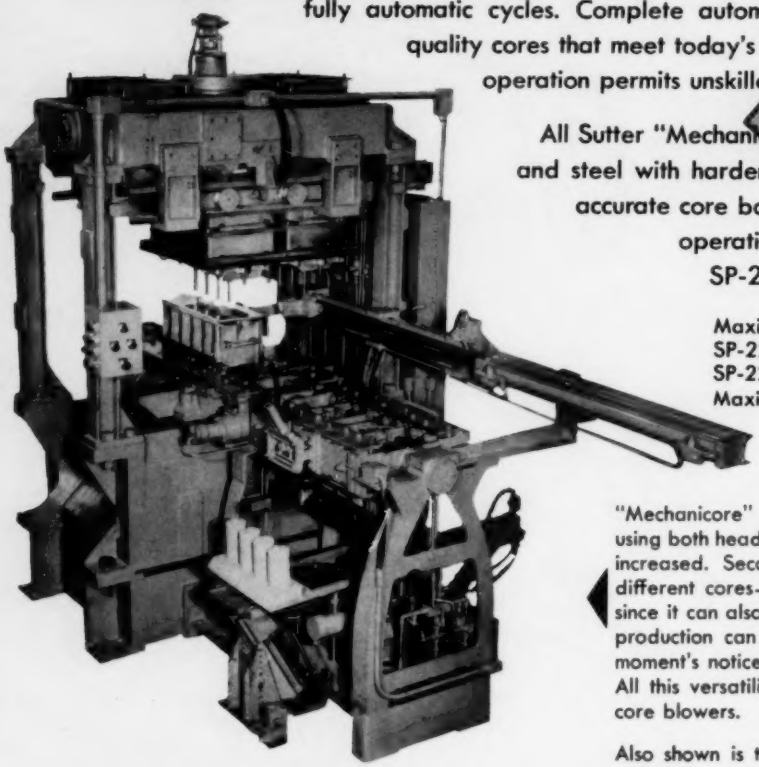
SUTTER

AUTOMATIC CORE BLOWERS

PAT. PENDING

Sutter "Mechanicore" Core Blowers provide up to 400 blows per hour with fully automatic cycles. Complete automatic operation results in consistent, high quality cores that meet today's rigid quality requirements. Too, automatic operation permits unskilled operators to maintain peak production.

All Sutter "Mechanicores" are sturdily constructed of cast iron and steel with hardened and ground guides and bushings for accurate core box and blow plate alignment, dependable operation and long life. Available in two models, SP-220 (single head) and SP-221 (dual head).



Maximum core box size
SP-220 . . . 36″ long x 20″ wide x 12″ deep
SP-221 . . . 36″ long x 15¾″ wide x 12″ deep
Maximum core weight 125 lbs.

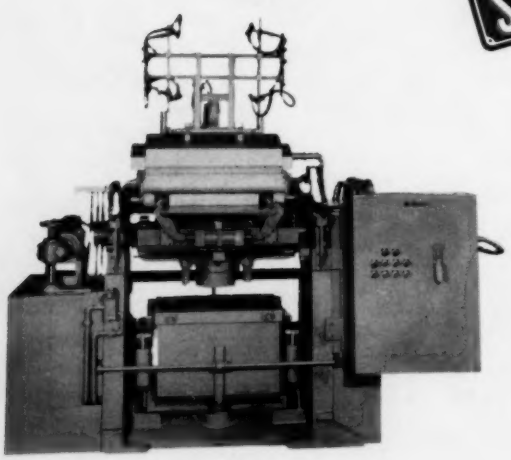
The Sutter SP-221 core blower provides flexibility that means easy scheduling of daily production. With the Sutter Dual-Head "Mechanicore" three different schedules can be achieved. First, using both heads for the same core, production can be substantially increased. Second, full production can be maintained on two different cores—even with different sand—simultaneously. Third, since it can also be used as a single head blower on either head, production can be switched from one core to the other with a moment's notice . . . no daily shut-down is needed for split runs. All this versatility without the cost of two complete conventional core blowers.

Also shown is the Sutter Automatic Transfer device which moves the blow cores from the blower to the draw machine and the Sutter Automatic Double Rollover Core Draw Machine with push out device.

more and better molds ..... at lower cost

SUTTER

AUTOMATIC SHELL MOLDING MACHINES



Sutter Shell Molding Machines provide completely automatic cycle . . . feature high production capacity.

Mold quality is automatic because the cycle is automatic. Yet variable coating and curing times permit exact quality and efficiency regardless of production requirements or the nature of the shell being produced.

Another important feature of Sutter Shell Molding Machines is their flexibility. Even short run production is completely practical because set-ups are so simple to make.

Labor costs are reduced, too, because an unskilled man can efficiently operate the Sutter Automatic Shell Molding Machine.

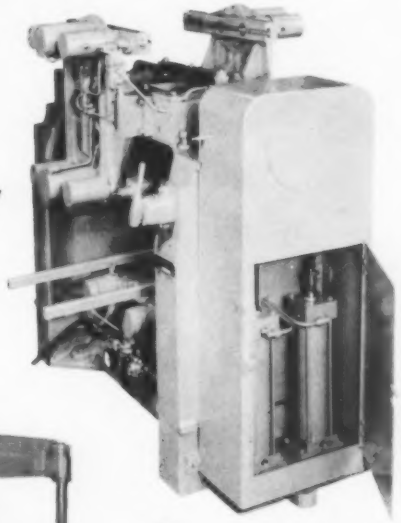
Maximum Mold size
SP-1000 . . . 20″ x 30″ x 6″ high
SP-1100 . . . 26″ x 41″ x 8″ high

INCREASE CORE QUALITY

SUTTER **AUTOMATIC CORE DRAW MACHINES *with Power Rollover***

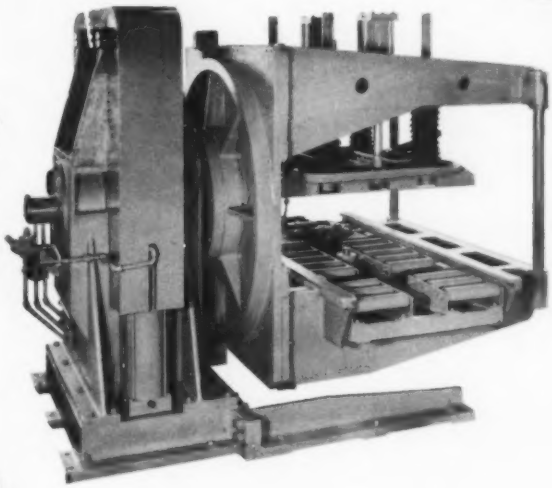
You can boost core output up to 400% with the Sutter Core Draw Machine. This has actually happened in foundries throughout the country.

Featuring power-rollover and automatic cycle, these core draw machines boost output while reducing operator fatigue . . . even unskilled operators can maintain top quality and output.

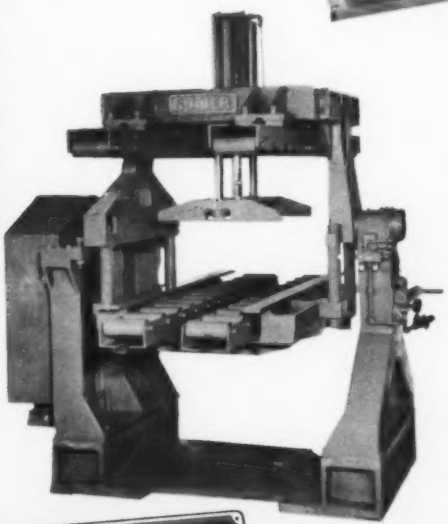


Automatic Double Rollover Core Draw Machine with side draw backs. Model SP-541. Cycle — approximately 20 seconds. Maximum Core box size 26" long x 13" wide x 10" deep

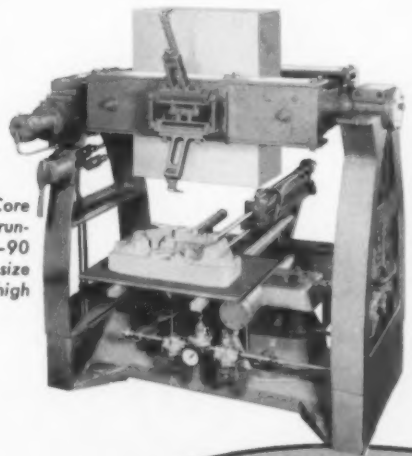
Automatic double rollover core draw machine. Automatic pushout device (Model No. SP-2020) which positions the drawn cores for easier removal. For use on all "SP-500" series machines.



Automatic single rollover core draw machine with single trunnion. Model SP-800 (three sides open). Maximum core weight—1500 lbs. Maximum core box size—50" long x 40" wide x 13" deep.



Automatic Single Rollover Core Draw Machine with double trunnion. Model SP-620. Cycle—90 per hour. Maximum core box size 38" long x 38" wide x 15" high (includes dryer)



OPERATING AT THE SHOW

In Booths 1310-1316

SUTTER **PRODUCTS COMPANY**

LARGEST PRODUCER OF AUTOMATIC CORE DRAW MACHINES

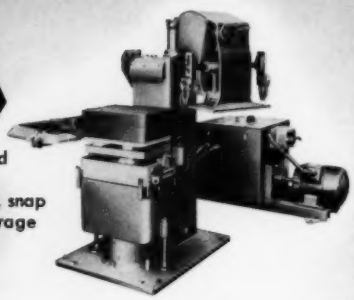
SP-1100 . . . 26" x 41" x 8" high

SUTTER SAND HANDLING EQUIPMENT

Reduces Labor . . . Reduces Costs

SUTTER (F.E.) BOXLESS MOLDING MACHINES

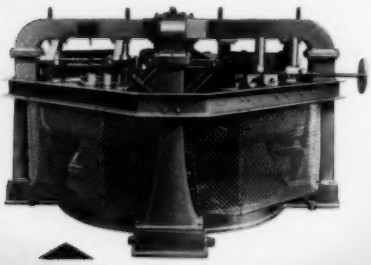
This machine is designed for production of molds for lightweight, shallow castings. Using a double faced pattern plate, copes and drags are rammed simultaneously without boxes, snap flasks or slip flasks. One man can average 100 complete molds per hour.
SP-3210—Mold size—12" x 17"



SUTTER (F.E.) SANDRAMMER JR.

Model SP-3510

You can produce better molds in less time with this versatile sandrammer. It is a compact, self-contained unit that can be used for a variety of production operations, including ramming cores. Design and construction assure positive ramming over the complete area and full depth of the mold. High volume sand output, large box coverage and simple operation make this the outstanding sandrammer for any application.



SUTTER (F.E.) SAND MILLS

continuous type Output—6 to 30 tons per hour

The design and action of these mills provide consistent, high quality molding sand . . . a perfect bond is created with any additives because every grain of sand is subjected to continuous rubbing and mixing. Sutter Sand Mills are the revolving pan type with four tapered mullers. Sand is forced in a gradual spiral to the center of the pan against centrifugal force. Equipment is also available that will permit immediate change-over to either batch or continuous milling.

SUTTER (F.E.) JOLT-SQUEEZE MOLDING MACHINE

Model SP-3010

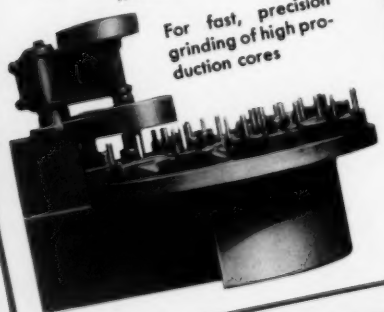
(for snap flask molding)

Sutter (F.E.) Jolt-Squeeze Molding Machines are the foundrymen's choice for greater production and less scrap.
With a swinging pressure head and adjustable jolt stroke, this machine can be used for producing many different molds. It is safe and simple to operate. Total pressure—3 tons. Maximum pressure stroke—5⅞". Maximum height between table and pressure plate—17½"

CORE GRINDING MACHINE AND FIXTURES

Model SP-4010

For fast, precision grinding of high production cores



In addition to the machines shown, Sutter also designs and manufactures equipment for automatic water testing of rough castings and custom-built equipment to fit your particular foundry requirements. If you want to increase your production and quality, and at the same time reduce costs, contact Sutter. Find out how the proper application of power and automaton can mean more dependable operation and more profits for you.

WRITE FOR YOUR FREE TECHNICAL BULLETIN TODAY.

Exclusive United States Sales Representative
FREDERIC B. STEVENS, INC.
Detroit 16, Michigan
Branches: Buffalo • Cleveland • Indianapolis • New Haven

Exclusive Canadian and Overseas Manufacturer and Distributor
FOUNDRY EQUIPMENT LTD.
Leighton Buzzard, Bedfordshire, England

See us at the **FOUNDRY SHOW**
•
BOOTHS 1310-1316

SUTTER PRODUCTS COMPANY

2005 WESTWOOD AVE. • DEARBORN, MICH.

CREATORS OF FOUNDRY EQUIPMENT WITH ***NEW*** PRODUCTIVITY

Foundrymen in the News

continued from page 54

Oscar H. Kraft has been appointed sales manager, Foundry Equipment Div., Westover Engineers, Milwaukee. He was for-

O. H. Kraft

B. H. Marks

merly associated with Bucyrus-Erie Co., South Milwaukee, where he was foundry superintendent and works manager at different times.

Bernie H. Marks is now manager of Pangborn Corporation's Houston, Texas, district office. He will operate in Texas, Louisiana, and the southern sections of Mississippi and Alabama. Mr. Marks was formerly at the Detroit office of the firm.

R. W. Knauft

D. E. Thal

Charles Taylor Sons Co., a wholly-owned subsidiary of National Lead Co., Cincinnati, has made the following management appointments: **Robert W. Knauft,** president; **M. C. Booze,** vice-president; **L. J. Woodcock,** treasurer; and **J. B. Henrich,** secretary.

Donald E. Thal, who has been sales manager of Link-Belt Company's Pacfic Division at San Francisco, is now the central general manager of that division. Mr. Thal has been with Link-Belt since 1936, at offices in Chicago, Seattle, and San Francisco.

Three changes in top management have been made at Eaton Mfg. Co. **R. H. Dalsley,** former vice-president of manufacturing, is now administrative vice-president in charge of all Eaton plants in Ohio, Kenosha, and London, Ont., Can. **F. H. Mott,** former general manager, pump division, is an administrative vice-president in charge of Eaton plant operations in Michigan. Former general manager of the stamping division, **R. E. Fisher,** is now vice-president in charge of sales for the entire company.

Aaron A. Leudtke has been named superintendent of the foundry at J. I. Case Co., Racine, Wis. He has been with the firm for 25 years and was formerly assistant superintendent.

Harold G. Lolley has joined Thiem Products, Inc., Milwaukee, as sales service engineer. Foundry superintendent at Rosedale Foundry & Machine Co., Pittsburgh, Pa., for the last three years, he was also formerly a foundry superintendent with Bucyrus-Erie Co., Erie, Pa.

Arthur S. Klopf has been appointed general sales manager, Missouri Coke & Chemical Division, Great Lakes Carbon Corp. He will be in charge of sales and marketing of premium foundry and industrial coke, coal tar, and other chem-

A. S. Klopf

H. G. Lolley

icals produced at the St. Louis plant for midwest, southwest, and Pacific users. He is former vice-president, Western Foundry Co., Chicago, and holds degrees from Marquette University and University of Wisconsin.

H. J. Karakas has been promoted from field engineer to manager of the newly created eastern seaboard sales division of Pfaudler Co., Rochester, N. Y. Mr. Karakas, a chemical engineer, was formerly eastern sales manager for the process engineering division, Patterson Foundry & Machine Co., East Liverpool, Ohio.

R. E. McNeill, Jr., president, Hanover Bank, has been elected a director of American Smelting & Refining Co. Mr. McNeill is active in many phases of industry and philanthropic work.

Howard E. Butters, formerly St. Louis district manager, has been appointed to the same position at the new Cleveland office of Joy Mfg. Co.

National Lead Co. has appointed a new manager for the metal division at its Cleveland branch office. **Henry A. Getz** has the new post, which includes Pittsburgh and Buffalo territories.

James R. Coley has been made secretary and sales manager, Ajax Electrothermic Corp., Trenton, N. J. He has been with the firm since 1928. **William T. Thomas,** formerly with General Electric Co., has joined the staff as assistant chief engineer.

Peninsular Grinding Wheel Sales Corp., Detroit, announces the appointment of **Louis E. Holm** as director representative of the company in western Michigan.

C. D. Galloway has been promoted from foundry superintendent to works man-

C. D. Galloway

G. H. Martin

ager at Chambersburg (Pa.) Engineering Co. **George H. Martin** succeeds him as foundry head.

Several personnel changes are announced by Lebanon Steel Foundry, Lebanon, Pa. **Harold C. Templeton** is now chief metallurgist. **Ray W. Patridge** has assumed the position of service manager for customer contact regarding shop problems. **Roy W. Daub** has been named chief planning engineer after 19 years with Lebanon.

Orville H. Scheel has been appointed sales engineer for Hydro-Blast Corp. in New York, Pennsylvania, New Jersey, Delaware, Maryland, New England, and Ontario.

Globe Iron Co., Jackson, Ohio, has reelected the following officers: **Edwin A. Jones,** chairman of the board; **Marshall H. Jones,** president, general manager, and treasurer; and **Winston Pfancuff,** secretary and sales manager. **Ernest J. Andberg** has been named manager of operations.

Tom Butler has been made special representative for Claude B. Schneible Co., Detroit. He will be available for consultation on special engineering problems involving the installation of company equipment for foundry dust collecting systems.

A. T. Olsson is now assistant to the sales manager, Acheson Colloids Co., Port Huron, Mich., where he will be headquartered.

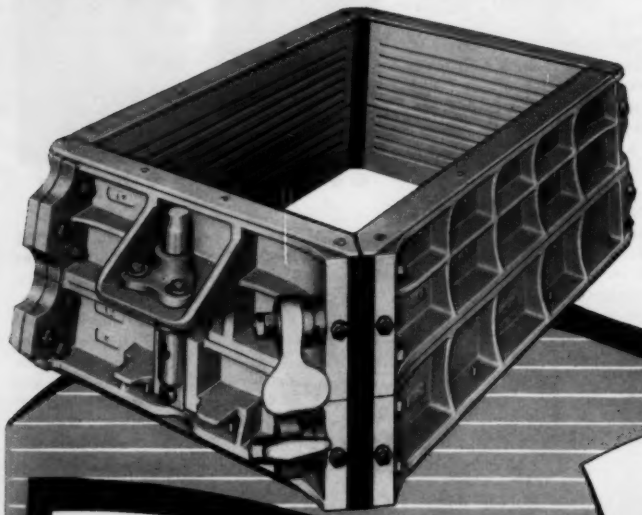
A. T. Olsson

Tom Butler

Be Sure to See the Popular New

FREMONT SPREADLOCK FLASKS at BOOTH 710

National Annual American Foundrymen's Society Foundry Congress-Cleveland Public Auditorium-May 8-14



No sand can lodge in the open corners of Spreadlock flasks. The corner gaps are completely closed by long-life, easily replaceable, live rubber inserts. Made of magnesium, which has twice the tensile strength of aluminum, they afford much longer service and are easier to handle. Accurately machined inside surfaces and flanges, and steel-faced top and bottom flanges assure more exacting work.

PERFECT ALIGNMENT INDEFINITELY!
Guaranteed by the one-inch GROOVLOCK FOOLPROOF PIN on

FREMONT STANDARD SLIP FLASKS

Particularly adapted to cope or drag pattern jobs. Solid, bolted and welded corner construction. Other types of standard pin fittings available.

SAVE BIG MONEY!
The precision machined and drilled, bolted corner construction of

FREMONT CAST IRON OR CAST ALUMINUM JACKETS

permits easy insertion of new sides or ends. Entire jacket need not be scrapped. The standard style is designed for ordinary foundry practice, the grooved style, which permits ready gas escape, is ideal for steel foundries. Flasks and jackets can be assembled on 3°, 4° or 5° taper.

Write today for free literature and prices. All orders given prompt attention.

THE FREMONT FLASK CO.
Fremont, Ohio

BENJ. HARRIS & CO.

OVER **50** *YEARS*

PRODUCERS OF

QUALITY BRASS & BRONZE

Ingot

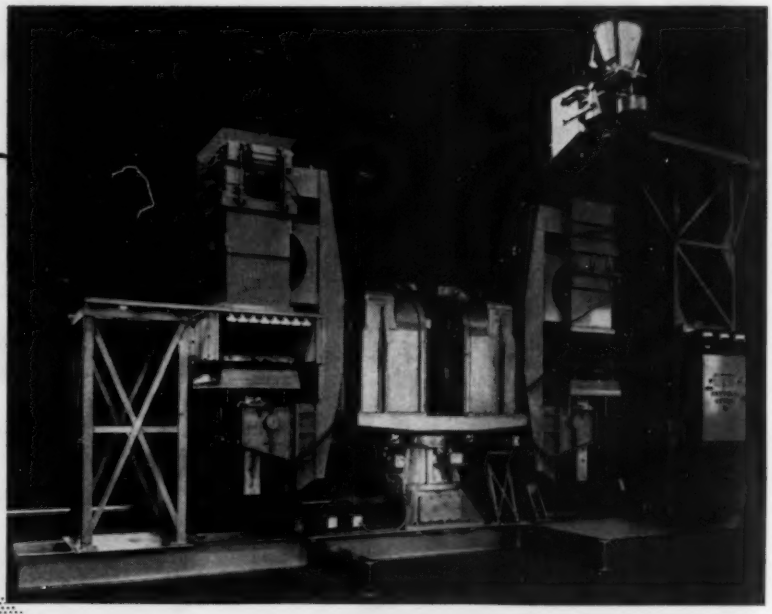
PROMPT AND DEPENDABLE SERVICE

ALL COMMERCIAL & GOVERNMENT SPECIFICATIONS SPECIAL ALLOYS

GENERAL OFFICES AND PLANT AT CHICAGO HEIGHTS, ILL.

SEE US IN BOOTH 215 AT AFS FOUNDRY SHOW

REDUCE SHELL MOLDING COSTS



One of the series of large size machines made by the Shell Mold Division, Beardsley & Piper, this shell mold machine features two pattern and dump box assemblies alternating on a rotary table between a fixed oven and a constant level sand-resin hopper. Quick pattern change-over, automatic oven time-temperature control and vertical sand-resin riffled rainfall are featured. Capable of handling patterns up to and beyond 30" x 40", it is available in single and multiple pattern units and in continuous rotary machines involving 10 or 12 heads or more.

specify DOW CORNING 8 EMULSION

...the Silicone Parting Agent that gives you clean, automatic release; helps assure fast, uninterrupted production

Whether you're using manual equipment or automatic machines, clean release is the key to dependably accurate shell molding at minimum cost. That's why you'll save money with Dow Corning 8 Emulsion. This non-corrosive, nonflammable silicone emulsion gives easy, positive release every time. It can't break down to form a carbonaceous deposit on even the most complex patterns. Cleaning costs are kept to a minimum because patterns stay cleaner longer. You also increase production of shells with consistently high dimensional accuracy.

Easily diluted in hard or soft water, Dow Corning 8 Emulsion is highly resistant to creaming or separating in storage or after dilution. Especially designed for the shell process, it is available at a new low price, 8% below that of previous emulsions. For more information and a free trial sample, write . . .

Send for sample TODAY

DOW CORNING CORPORATION, Dept. AV-17
Midland, Mich.

Please send me ☐ Free sample of Dow Corning 8 Emulsion
☐ Data on Silicone Release Agents for the Shell Process

Name _____

Company _____

Street _____

City _____ Zone ___ State _____

DOW CORNING DOW CORNING SILICONES **CORPORATION**
MIDLAND MICHIGAN

ATLANTA CHICAGO CLEVELAND DALLAS DETROIT LOS ANGELES NEW YORK WASHINGTON, D.C. (Silver Spring, Md.)

Canada: Dow Corning Silicones Ltd., Toronto Great Britain: Midland Silicones Ltd., London France: St. Gobain, Paris

Gallery of the Best

Here at Ohio Ferro-Alloys Corporation we have a fine collection of quality ferro-alloys which help metal makers manufacture products to meet the exacting specifications of today's customers. Available in lump, crushed and briquet form, these ferro-alloys are readily obtainable from strategically-located plants and warehouses serving your area. Write for information on how we can help you solve your production problems.

Ohio Ferro Products

- FERRO - SILICON 25 - 50 - 65 - 75 - 85 - 90%
- SPECIAL BLOCKING 50% FERRO - SILICON
- SILICON METAL
- HIGH CARBON FERRO-CHROME
- LOW CARBON FERROCHROME
- LOW CARBON FERRO-CHROME SILICON
- FERRO - MANGANESE
- SILICO-MANGANESE
- BOROSIL
- SIMANAL
- RARE EARTH ALLOYS

Briquets

- SILICON
- MANGANESE
- SILICO-MANGANESE
- CHROME

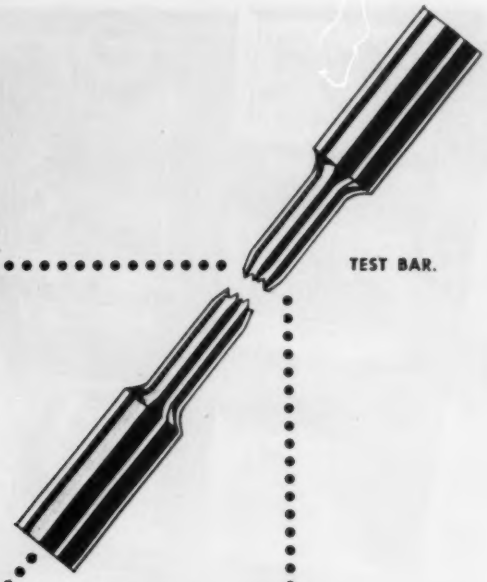
DEPENDABILITY · QUALITY · SERVICE

Ohio Ferro-Alloys Corporation

Canton, Ohio

Chicago Detroit Pittsburgh Tacoma Seattle
Minneapolis Birmingham San Francisco Los Angeles

THERE IS A SOLUTION
TO YOUR COSTLY...
Foundry Problems..



Quality Control

When you call upon
LAVIN'S ENGINEERING SERVICE

QUALITY CONTROL IS THE GOAL OF EVERY FOUNDRYMAN . . .

The quality of castings is governed by proper melting procedures, accurate gating and risering, directional solidification and choice of suitable alloy required for any designated application.

Test bars and other scientific methods are being constantly employed in our research laboratories in order to insure the high standards required by the nonferrous industry.

Lavin's metallurgical staff is always ready to assist the foundryman in finding the solution of any routine or special casting problem. Our chemical and research laboratories are available to you at no cost or obligation.

Next time call upon LAVIN'S engineering service
"The Foundryman's Problems Are Our Problems"

FREE—WRITE FOR YOUR COPY OF THE 8 PAGE LAVINGOT TECHNICAL JOURNAL VOL. 9, NO. 4, CONTAINING A COMPLETE ARTICLE ENTITLED—"GATES & RISERS FOR MANGANESE BRONZE"

RESEARCH — CONTROLLED REFINING INSURE UNIFORM QUALITY

• REFINERS OF BRASS, BRONZE AND ALUMINUM • PRODUCERS OF ZINC BASE DIE CASTING ALLOYS • DEOXIDIZERS . . . DEGASIFIERS . . . FLUXES . . . SHOTS • CAST VIRGIN ELECTROLYTIC COPPER ANODES • TYPE METALS.

R. LAVIN & SONS, INC.

• OFFICES—Boston, Pittsburgh, Cincinnati, Minneapolis, Philadelphia, Cleveland and Detroit
• WAREHOUSES—Boston, Philadelphia, Pittsburgh, Cleveland, Detroit, Minneapolis and Houston

3426 S. KEDZIE AVENUE • CHICAGO 23, ILLINOIS
REPRESENTATIVES IN PRINCIPAL CITIES

R. LAVIN & SONS, INC. 1900 54 Years 1954 SERVING THE FOUNDRY INDUSTRY

semi-mechanize with a bucket loaded ROYER

MODEL "NYP-E" one of the new "NY" series

Now, small and medium sized foundries can afford advantages formerly available only to the larger production shops. Royer is offering a complete new line of sand conditioning equipment designed to semi-mechanize sand handling in any foundry. The Royer "NY" series of Sand Separators and Blenders is built to handle sand from the discharge of mullers or front end bucket loaders. The series consists of both portable and stationary models, with and without extension hoppers. Illustrated is "NYP-E", portable with extension hopper.

Like all Royers, the "NY" Series gives complete sand preparation: thorough blending and mixing, lump breaking, increased permeability, even moisture distribution and double aeration. Discharged sand is light and fluffy, ready for the molder's use.

See the "NYP-E" in action at the Foundry Show . . . or write for more detailed specifications.

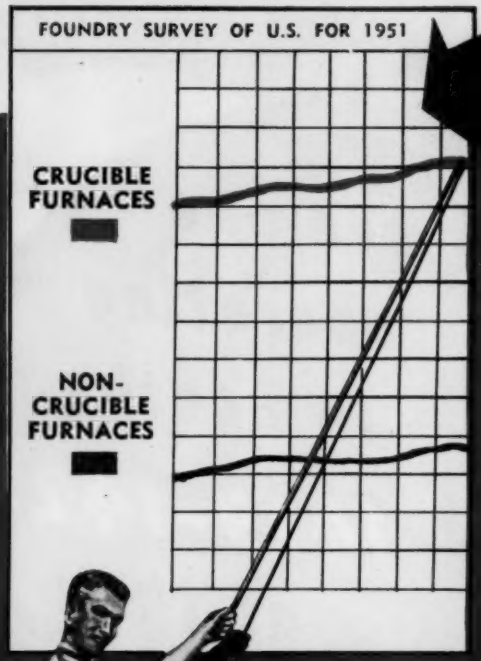
Export Department, 306 W. Washington Blvd.
Chicago 6, Ill., U.S.A. Cable: ASMAN

Foremost in Sand ROYER *Conditioning Equipment*

ROYER FOUNDRY & MACHINE CO. 155 PRINGLE ST. KINGSTON, PA.

CRUCIBLE MELTING

... LEADS three to one



A foundry survey* of the United States for 1952 gives capacity of all Crucible furnaces at 6,043,720 lbs. of non-ferrous metals: all non-Crucible furnaces, capacity, 1,332,585 lbs.

According to the same survey, the total capacity per charge of all Crucible furnaces is rapidly increasing; thus, in 1951 the Crucible furnace capacity was 4,703,037 lbs., an increase of 1,340,683 lbs., or an increase for 1952 of 28.5%.

Foundrymen know their melting methods. Such persistent popularity and preference result from a combination of advantages obtainable only with Crucible melting.

*The Foundry Market—August, 1953 Published by *Foundry*

CRUCIBLE MELTERS' HANDBOOK SENT FREE; GIVES INFORMATION ON THE CARE AND USE OF CRUCIBLES.

CRUCIBLE MANUFACTURERS ASSOCIATION

70 EXCHANGE PLACE NEW YORK 5, N. Y.

THESE FIRMS CAN TAKE CARE OF ALL YOUR REQUIREMENTS FOR CRUCIBLE MELTING

AMERICAN REFRACTORIES & CRUCIBLE CORP.

ELECTRO REFRACTORIES & ABRASIVES CORP.

JOSEPH DIXON CRUCIBLE CO.

ROSS-TACONY CRUCIBLE CO.

LAVA CRUCIBLE-REFRACTORIES CO.

VESUVIUS CRUCIBLE CO.

Talk of the Industry

SAND SUPPLY PROBLEM of Fairbanks-Morse's Beloit (Wis.) foundry and waste sand disposal of another shop have been solved. Truck, which takes sludge from F-M wet classifiers to dump, stops at other foundry on way back to pick up load of waste sand. This is passed through wet classifier and reclaimed to keep up volume of F-M sand. Fairbanks-Morse gets added sand for cost of hauling and reclaiming, and other foundry has its waste sand removed free.

NO BLOWS occur in shell molds cemented with a poly vinyl glue, even when the material flows out into the mold cavity, according to a shell mold casting producer. The glue, applied to the hot shells from a regular core-paste bulb, sets as the assembled mold is held under pressure in a multiple-spring loaded clamping device.

MOST FOUNDRYMEN KNOW HOW to keep house, but not all of them are applying their knowledge, according to C. G. Lauckner III, facilities engineer, General Electric Co., Schenectady, N. Y., speaking at the Wisconsin Regional Foundry Conference. If you are operating a jobbing foundry and are not in the top 25 per cent in appearance and good housekeeping, you may not be making the net profit you should be, he said. If you are operating a captive shop and can't qualify among the top 25 per cent, you are not maintaining the foundry in the condition your company should expect.

PERFECTION IN ATOMIC STRUCTURE of iron crystals made in a General Electric Co. research laboratory is believed to account for their high strength and corrosion resistance. Produced as "whiskers" a thousandth of an inch thick and an inch long, the crystals are some 100 times stronger than previously made crystals that were believed to be nearly perfect. They have a mysterious "built-in" resistance to corrosion.

ON FEBRUARY 1, Lone Star Steel Company, Lone Star, Texas, began a unique innovation in safety incentives. The plant's safety department has been handing out silver dollars to employees who are wearing safety shoes. A contest is being conducted each week and a total of ten silver dollars is awarded to the safety shoe wearers weekly. One day each week, ten time cards are selected at random by a committee. If the men are found to be wearing their shoes, they receive the award. The shoes are equipped with steel caps that withstand up to 3000 lb pressure and are sold at cost by the company warehouse.

ZINC IS FREELY AVAILABLE, according to American Zinc Institute reports. Supplies are said to be sufficient to meet both near and long-range requirements. Although 1953 production figures are not released, incomplete reports indicated that the record output of 1943 would be nearly equaled. Since 1946, zinc production in the free world has increased exactly 50 per cent. Ample stocks of all grades of slab zinc were on hand at smelters at year's end.

58th A.F.S. FOUNDRY CONGRESS & SHOW

CLEVELAND • MAY 8 TO 14 • 1954

CLEVELAND becomes the focal point of the metals casting industry during the week of May 8-14, when the 58th Annual AFS Convention and Foundry Show will be held at the Public Auditorium.

Foundrymen from every section of the U. S., Canada, and several foreign countries will gather in the Ohio metropolis for the most pretentious program of technical sessions, business meetings, social events, plant visitations, and display of foundry equipment since American Foundrymen's Society held its first meeting at Philadelphia in 1896.

Metallurgists, engineers, technologists, research men, educators, government scientists, and working foundrymen with their wealth of practical know-how will meet for a week of the most comprehensive interchange of metals casting knowledge and practice available anywhere.

The largest showing of foundry machinery and materials in the history of the AFS Foundry Shows will be staged simultaneously in the multi-level Public Auditorium. More than 300 exhibitors will display over $3 million worth of equipment in over 100,000 sq ft of floor space, making this Show a record-breaker in every respect. Many old-line companies are using more space than ever before, and some 60 exhibitors are showing for the first time. About 20 per cent of the exhibits will feature operating equipment.

The Exhibit will open for a limited showing on May 8, Northeastern Ohio Day, when admission will be free to employees of plants in the Cleveland area only. Beginning Monday, May 10, the Show will be open daily from 9:30 am to 5:30 pm. Only exception is Wednesday, May 12, when doors will not open until noon because of the Annual AFS Business Meeting in the morning. Official closing of the Show is 1 pm, Friday, May 14.

More than 60 technical meetings have been scheduled from May 10-14, inclusive. Forty-two technical sessions will be held, with some 90 papers presented by over 100 of the most astute foundrymen in the world. Five international papers will be presented, covering various phases of gray iron, brass and bronze, and sand practice. Other sessions will feature research reports on AFS projects. Eight round-table luncheons will be held, with the Sand Division scheduling one for the first time. Ten shop courses, more than ever before, will be held during evening hours, with malleable and refractories sessions also being staged for the first time. There will be no admission or registration required for shop courses, which are intended to disseminate as much practical information for working foundrymen as possible.

Special Interest Events

The program of social events and business meetings is a busy one. The President's Reception and International Reunion will be held Monday afternoon, May 10, to be attended by all AFS Past Presidents, present and incoming Board members, National Castings Council representatives, all foreign attendance, host chapter officers and directors, and those who attended the International Foundry Congress in Paris last year.

The Canadian Dinner will be held in the Hotel Cleveland ballroom on Tuesday evening, May 11. The Annual AFS Business Meeting is set for the Auditorium ballroom on Wednesday morning, May 12. In addition to the discharge of Society business, awards will be announced in the national Apprentice

AMERICAN FOUNDRYMEN'S SOCIETY

A. F. S. CONVENTION MAY 8 TO 14 • 1954

Contest. The Charles Edgar Hoyt Annual Lecture, delivered by Harry W. Dietert, H. W. Dietert Co., Detroit, will follow immediately after the Business Meeting.

One of the week's high points will be the Annual Banquet, scheduled for 7 pm, Wednesday, May 12, in the Public Auditorium Arena. A sumptuous feast will be followed by presentation of AFS awards and a program of variety entertainment.

The annual AFS Alumni Dinner is invitational and will be held on Thursday, May 13 at the Union Club. All past national officers and directors and members of the Society "official family" are urged to attend.

In addition to these AFS functions, various other industry organizations will hold meetings in Cleveland during the week. These include the Non-Ferrous Founders' Society annual dinner meeting, National Castings Council, and National Foundry Association.

Big Apprentice Contest

Like most phases of the 1954 Convention, the national Apprentice Contest will be the largest in AFS history, with 12 chapters participating. Winning patterns and castings will be on display at the Convention in a special exhibit booth.

A Publications counter will be installed in the AFS Headquarters booth. Foundrymen will be able to inspect and order the most recent Society publications, including *Symposium on Foundry Sand Reclamation, Symposium on Molding Machines,* and *Volume 61* of the Annual *AFS Transactions.* A dummy issue of the *Second Edition, Cupola Operations Handbook,* will be available.

Ladies of foundrymen visiting the Convention will find a full program of entertainment arranged by the committee of the host chapter. Teas, luncheons, dinners and the Annual Banquet highlight the week. The program is printed on page 95 of this issue.

The Plant Visitations schedule has been expanded since 1950 and metals working plants on the program include the entire range of foundry practice. A May 14 visit to the Ford Motor Co. Cleveland Foundry will climax the week.

Registration for the Convention and Exhibit is being handled as in recent years. Members will pay a $2 fee, non-members $5. Advance registration by mail has been underway for some time for regular and company members of AFS. A registration badge will be required for all sessions and admission to the exhibit halls. Only exception will be the evening shop courses, where *no registration is required.* For the convenience of foundrymen, the Registration booth will be located near the main Lakeside entrance to the Public Auditorium.

The following sections list the principal features of the technical sessions, grouped by divisions. The complete program is printed in this issue.

Brass and Bronze

This Division has scheduled three technical sessions, two shop courses, and a noon-time round table luncheon. Opening on Monday, May 10 at 10 am, papers will be: *Ornamental Yellow Brass Castings Gated for Greater Economy,* and *Some Experiences in the Shell Molding of Copper-Base Alloys.* The Monday afternoon session will feature four papers: *Research in Progress for the Bureau of Ships, Department of the Navy; Valve Stem Dezincification; Pressure Molding for Copper-Base Alloys,* and *Melt Quality Tests for Bronze Alloys.* Final Division technical session will be on Tuesday morning, May 11, with these papers: *Application of Chills to Improving the Pressure Tightness of Gun Metal;* and *Some Factors Affecting Metal Penetration of Navy 'M' Bronze in Cores.*

The two Division shop courses are set for Monday and Tuesday, May 10 and 11, at 4 pm. Subject for the first meeting is *Core Boxes, Ovens and Driers;* that at the second is: *Practical Know-How of Core Blowing and Machine Maintenance,* and *Oil Bonded and Resin Bonded Cores. Toward Improved Foundry Practice* is the topic for the round table luncheon, Tuesday, May 11.

Light Metals

The Light Metals Division is offering four technical sessions and a round table luncheon. First of the sessions is at 10 am, Monday, May 10, where foundrymen will hear: *Gating and Risering of Magnesium Alloys, Segregation in Magnesium—Rare Earth—Zinc—Zirconium Alloys,* and *Beryllium in Magnesium Die Casting Alloys.* At 4 pm on Monday, these papers will be presented: *New Aluminum Die Casting Alloys, Mechanical Properties of Aluminum Die Casting Alloys,* and *Some Factors Affecting Fatigue Strength of Aluminum Alloy Sand Castings.*

At the Tuesday morning session two papers are on the program: *Effect of Centrifugal Force on the Structure and Mechanical Properties of Aluminum Casting*

Alloy C4, and *Technique for Improving the Strength and Ductility of Aluminum Alloy Castings.*

Final Division meeting is at 2 pm, May 11. Papers will be: *A Bottom-Pour, Arc Type Furnace for the Melting and Casting of Titanium, Mechanical Properties of Cast Titanium-Aluminum Alloys, Expendable Molds for Titanium Castings,* and *Techniques for Producing Titanium Alloy Castings.*

The Light Metals round table luncheon will be held on Monday, May 10, at noon. Speakers will cover, *The Principles of Vertical Gating,* and *Transparent Plastic Models for Study of Fluid Flow Characteristics in Investment Molds.*

Malleable Iron

Three sessions, two shop courses, and a round table luncheon are on the Malleable Division program. First session is at 10 am on Monday, May 10. Papers are: *On the Effect of Plastic Deformation of Hard Iron on Subsequent Annealing,* and *The Prebaking Effect in Malleabilizing.* The Monday afternoon session at 2 pm will present: *Some Effects of Melting Furnace Atmosphere on Tensile Properties and Annealability of Malleable Iron,* and *Strength of Some White Irons in the Temperature Range of Hot Tearing.* The 10 am session on Tuesday, May 11, will offer: *The Graphitization of Rims in Malleable Iron,* and *The Effect of Atmospheres on the Rate of Anneal of Black Malleable Iron.*

First Malleable shop course is set at 4 pm, Monday, May 10. *Melting Malleable Iron* is the general subject, with these papers presented: *Cupola Melting Fundamentals, Cupola Melting at Belle City Malleable,* and *Cupola Melting at Auto Specialties.* The second shop course, Tuesday, May 11, at 4 pm, will offer a panel discussion of *Malleable Annealing Practice.*

Two speakers will discuss *Effective Use of Melting Controls in Duplex and Direct Furnace Melting* at the Tuesday noon round table Luncheon.

Harry W. Dietert to Deliver Charles Edgar Hoyt Lecture

PROCESSING MOLDING SAND is the title of the Charles Edgar Hoyt Annual Lecture for 1954, to be presented by Harry W. Dietert, chairman of the board, Harry W. Dietert Co., Detroit, immediately following the Annual Business Meeting. The lecture will present an authoritative coverage of every phase of foundry sand technology.

Harry W. Dietert

Mr. Dietert, currently a National Director of AFS, is a past winner of the Wm. H. McFadden Gold Medal and has been continually active in foundry sand research. He earned a B. S. at Iowa State College, 1920, followed by an M. S. at University of Illinois, 1923.

Pattern

The Pattern Division is holding two technical sessions and a round table luncheon. The first session, 2 pm, Monday, May 10, will feature *Investment Casting by the Frozen Mercury Process,* and *Blow-In Driers.* The other session will be held on Tuesday, May 11, at 10 am. Papers will be: *Pattern Equipment for Shell Molding,* and *Use of Plastics in Pattern Making.*

The round table luncheon will be served at noon, Wednesday, May 12. Panel discussion will cover *Pattern Development and Problems,* following a paper on *Accuracy and Tolerances for Patterns.*

Gray Iron

The Gray Iron Division, as in the past, is one of the most active groups. Six technical sessions are set, augmented by three shop courses, and a round table luncheon.

Monday, May 10 at 8 pm is the time for the first meeting, where the paper will be: *Coke Screening and its Relation to Cupola Operation.* A discussion will follow. Second session is at 4 pm, Wednesday, May 12, with three papers: *Studies on the Machinability and Microstructure of Cast Irons, The Machining Characteristics of Cast Irons,* and *Fluidity vs. Core Blows in Automotive Gray Iron.*

On Thursday, May 13, at 10 am, three papers will be offered: *The Theoretical Aspects of Oxygen in Cast Iron, Some Variables in Acid Cupola Melting,* and *The Melting of Cast Iron Borings and Steel Turnings in the Cupola.* The last is the official British exchange paper.

The official exchange paper of the Victoria branch, Institute of British Foundrymen: *Australian Methods of Producing Special Pipes,* will feature the 2 pm session on Thursday. Also presented: *The Importance of Cooling Rate on Physical Properties of Gray Cast Irons,* and *The Risering of Semi-Circular Plate Castings.*

Another session follows at 4 pm, where three papers are programmed: *Risering of Gray Iron Castings, Calcium Carbide Injection—A New Metallurgical Tool for the Foundryman,* and *Alloying and Heat Treating Spherulitic Graphite Cast Iron.*

Final Gray Iron technical session will be on Friday, May 14, at 10 am. The papers are: *Effect of Graphite Flake Size Upon the Tensile and Fatigue Properties of Gray Cast Iron, The Relationship of the Carbon Equivalent to the Properties of Cast Iron,* and *Graphitization of Certain Fe-C-Ti Alloys.*

First of three Division shop courses will be held at 8 pm, Monday, May 10, where the discussion will cover *Coke Screening and its Relation to Cupola Operation. Gating to Control Pouring Rate and its Effect on Casting Quality* is the subject for the second shop course at 8 pm, May 11. Final shop course is at 8 pm on Thursday, May 13. Discussion will center on *Cupola Bed Practice.*

The Division round table luncheon will be served at noon, Wednesday, May 12. Three speakers will discuss: *High Lights of our European Trip, European Metallurgy and Melting Practice,* and *European Molding, Core Making, and Production Equipment.*

Sand

The Sand Division has the honor of providing the Charles Edgar Hoyt Annual Lecturer for this Convention: Harry W. Dietert, Detroit, who will discuss, *The Processing of Molding Sands.* Seven regular sessions are on the program, running through the entire week.

First technical session, at 8 pm, Monday, May 10, features a panel discussing: *Fundamentals of Sand Control. Another Look at Sand Grain Distribution,* and *Fundamentals Make Better Castings* are the subjects of papers to be presented at 2 pm, May 12. At 4 pm on the same day, papers will be: *Casting Quality as Related to the pH Value of Molding Sands, Food for Thought: What is Basic to the Selection and Mulling of Synthetic Sands,* and *Pre-Mixing of Reconditioning Materials for Molding Sand.* A 10 am session, Thursday, May 13, offers: *Recent Developments in Shell Molding, Pressure Molding with Standard Synthetic Sands,* and *Research on Shell Molding.*

Two sessions are scheduled for the afternoon of May 13. At 2 pm, foundrymen will hear: *Core Blowing Problems, What is Stickiness in Core Sand Mixtures,* and *Olivine-Silica Molding Sands.* The 4 pm session offers: *A Method of Establishing Standards for As-Cast Surfaces, Improving Surface Finish on Gray Iron Castings,* and *Statistical Analysis of Factors Affecting Casting Finish.*

The Division concludes its schedule with a 10 am session on Friday morning, May 14. Three papers are offered: *The Investigation of Steel Foundry Sands at Elevated Temperatures, The Effect of Moisture Content on Silica Sand,* and *Metal Penetration Tests on Dry Sand Cores and Core Washes.*

Sand Division shop courses are set for 8 pm on May 10, 11, and 13. The first meeting will feature panel discussion of *Fundamentals of Sand Control.* At the second session, a new panel will further explore the same subject. Still a third group will conclude the informal discussion at the final meeting.

What's in the Future is the general theme for the Sand round table luncheon at noon, Tuesday, May 11. Short reports by Division committee chairmen will be featured.

Industrial Engineering

The Industrial Engineering Committee will hold two technical sessions, one at 10 pm, Tuesday, May 11, and the other at 2 pm on the same day. The morning session will hear these papers: *Time Distance Charts-Analysis of Work Content; Time, Distance and Speed at Conveyor Stations,* and *Educating Management to a Valuable Tool.*

The afternoon meeting will have two papers: *An Incentive Plan for 'Line' Supervisors,* and *A Measured Daywork Program.*

Education

A round table luncheon and two technical sessions will be offered by the Educational Division. With *In-Plant Training* as the subject, speakers will cover: *Developing All Levels of Management,* and *A Short Course in Foundry Skills.* The second session, at 4 pm on May 11, will present a five-man panel discussing: *What Does the Foundry Industry Want AFS to do in Educational Work on the Local Chapter Level?*

The luncheon will highlight *Human Engineering,* and will be held at noon, Tuesday, May 11.

AFS Gold Medal Awards

Roy A. Gezelius

PETER L. SIMPSON GOLD MEDAL

"For outstanding contributions to the steel casting industry, particularly in the development and production of cast armor plate."

After receiving degrees at Michigan State College, Mr. Gezelius worked in government research and industry until his 1939 affiliation with General Steel Castings Corp., where he is now works manager.

Thomas E. Eagan

SEAMAN GOLD MEDAL

"For outstanding work in the development and dissemination of engineering data on the production and utilization of alloy cast irons."

Mr. Eagan was educated at Columbia University and Missouri School of Mines. He joined Cooper-Bessemer Corp. in 1934 and is now chief research metallurgist. He is a past national AFS Director.

Walter E. Sicha

WILLIAM H. MCFADDEN GOLD MEDAL

"For extensive and valuable work on light metals casting alloys and for outstanding contributions to the Society."

Born in Cleveland, Mr. Sicha obtained degrees from Case Institute of Technology and University of Michigan. With Aluminum Company of America since 1929, he is now chief of Cleveland Research Division.

Plaster Mold Casting

The Plaster Mold Casting Committee will hold a single technical session at 2 pm, Tuesday, May 11. Three papers will be on the program: *Improving the Thermal Conductivity and Economy of Foam Plaster Molds, Some Practical Applications for Expansion Plaster,* and *History and Development of Plaster Mold Castings.*

Steel

All Steel Division sessions are scheduled for the final three days of the Convention. Three meetings are planned. The first, at 2 pm, Wednesday, May 12, will offer three papers: *The Stress Required to Hot Tear Plain Carbon Cast Steel: Effects of Tearing Temperature, Composition and Deoxidation Practice, Influence of Core Material on Hot Tearing of Steel Castings,* and *Report on Metallurgical Investigation at Armour Research Foundation.* A panel discussion will follow.

Two papers will be presented at 10 am, Thursday, May 13: *Effect of Pouring Temperature on the Soundness and Physical Properties of Steel Castings,* and *Why Did It Fail?* The 10 am session, Friday, May 14 will cover: *Factors Which Determine Riser Adequacy Feeding Range,* and *The Design and Operation of a Modern Heat Treating Department.*

The Division round table luncheon is scheduled for noon, Thursday, May 13. The full program for this meeting had not been announced at press time.

Heat Transfer

Two meetings have been arranged by the Heat Transfer Committee. At the first, 2 pm, Wednesday, May 12, subjects will be: *Solidification of Finite Cylinders, Heat Transfer Characteristics of Shell Molds,* and *Solidification of Various Metals in Sand and Chill Molds.*

The second session, 10 am, Thursday, May 13, will feature: *Heat Transfer of Various Molding Material for Steel Castings,* and *Studies of Chill Action.*

Refractories

The Refractories Committee will hold a session on Wednesday, May 12, at 2 pm. Two papers will be offered: *Economic Considerations in Refractory Ladle Practice,* and *Correlation of Air Furnace Bottom Temperature to Refractory and Operating Practice in a Cupola-Air Furnace Duplex System—Part II.*

A Refractories shop course will be scheduled at 2 pm, Thursday, May 13. A panel will discuss: *The Importance of Refractories in Your Foundry.*

Plant and Plant Equipment

A Plant and Plant Equipment Committee session has been arranged for 4 pm, Wednesday, May 12. *Development of Cupola Melting Equipment,* and *Cupola Dust Collectors* will be the subjects of the two technical papers.

Safety & Hygiene & Air Pollution

Three sessions have been scheduled by this Division in three general areas of interest. A Dust Control and Ventilation meeting will be held at 2 pm, Tuesday, May 11. Six papers will be heard: *Foundry Hygiene Problems, Principles of Foundry Ventilation, Principles of Exhaust Ventilation, Ventilation of Sand Handling Equipment, Cooling of Castings,* and *Principles of Effective Maintenance of Foundry Ventilation and Dust Collecting Equipment.* A Committee progress report will also be presented at the meeting.

The Safety session convenes at 4 pm, Wednesday, May 12 with an ambitious program. Papers are: *Value of the Safety Program to the Foundry, The Camera Aids Our Housekeeping and Inspection Program, Training in Accident Prevention, Protective Equipment,* and *Engineering Safety into New Methods.* A round table discussion follows: *What's the Big Problem in Your Safety Program?*

An Air Pollution Control session is set for 2 pm, Thursday, May 13. A round table discussion, *Control of Emissions from Metal Melting Operations,* will follow three papers: *Experiences with the Use of a Spray Type Collector on a 72-inch Cupola, Cupola Fly-Ash Suppression,* and *Cupola Emission Control.*

Cost

The Cost Committee will hold a general question and answer session at 2 pm, Thursday, May 13, with a seven-man panel of experts replying to foundry cost problems.

Honorary Life Members

Collins L. Carter

"For outstanding service as President of American Foundrymen's Society during the term 1953-54."

Educated at Cornell University, Mr. Carter joined Albion Malleable Iron Co., in 1929 became president and general manager in 1938. He is past president of Malleable Founders Society and of National Castings Council, and a trustee of F.E.F.

Leroy P. Robinson

"For outstanding and long-sustained service to the Society and its Chapters, and for singular contributions to the improvement of foundry core room practice."

Graduating from Lombard College in 1906, Mr. Robinson was active in several fields before entering the foundry industry in 1917 with the Werner G. Smith Co. He joined Archer-Daniels-Midland Co. in 1950, is now vice-president, Foundry Products Division.

Earl M. Strick

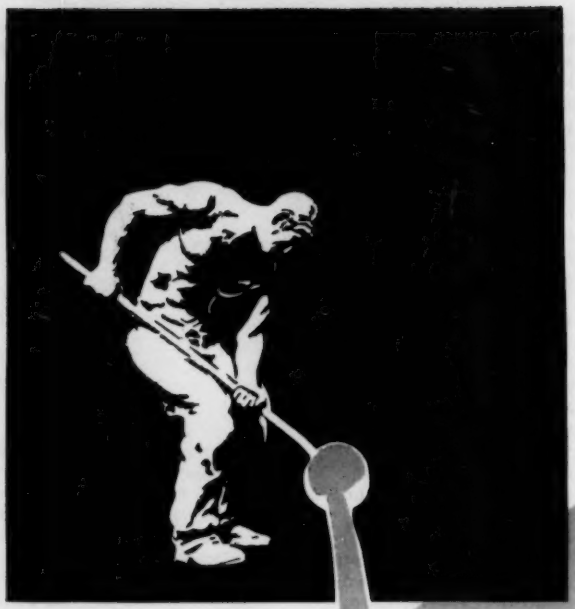
"For outstanding work in the development and encouragement of foundry interest at the high school and trade school level through the medium of local Chapters."

Mr. Strick's 40 years at Erie Malleable Iron Co., where he is now finishing superintendent, represent all but three of his experience in the industry. He helped organize Northwestern Pennsylvania Chapter in 1945, has not missed a meeting since.

LIST OF EXHIBITORS
1954 AFS Foundry Show

Acme Resin Corp.	Forest Park, Ill.
Adams Co.	Dubuque, Iowa
Aerodyne Development Corp.	Cleveland
A. I. C. Engineering Co.	Indianapolis
Air Reduction Sales Co.	New York
Ajax Electric Furnace Corp.	Trenton, N. J.
Ajax Electrothermic Corp.	Trenton, N. J.
Ajax Flexible Coupling Co., Inc.	Westfield, N. Y.
Ajax Metal Div., H. Kramer & Co.	Philadelphia
Allis-Chalmers Mfg. Co.	Milwaukee
Alloy Metal Abrasive Co.	Ann Arbor, Mich.
Alpha-Lux Co., Inc.	New York
American Air Filter Co., Inc.	Louisville, Ky.
American Alloys Corp.	Kansas City, Mo.
American Colloid Co.	Chicago
American Conveyor Co.	Chicago
American Fire Clay & Prods. Co.	Canfield, Ohio
AMERICAN FOUNDRYMAN	Chicago
American Gas Association	New York
American Metal Market Co.	New York
American Refractories & Crucible Corp.	North Haven, Conn.
American Silica Sand Co., Inc.	Ottawa, Ill.
American Steel Abrasives Co.	Galion, Ohio
American Tank & Fabricating Co.	Cleveland
American Wheelabrator & Eqpt. Corp.	Mishawaka, Ind.
Apex Smelting Co.	Chicago
Archer-Daniels-Midland Co.	Cleveland
Arrow Pattern & Engineering Co.	Erie, Pa.
Austin-Western Co.	Aurora, Ill.
Automatic Foundry Eqpt., Reichert, Inc.	Newark, N. J.
Ayers Mineral Co.	Zanesville, Ohio
Baird Associates	Cambridge, Mass.
Bakelite Co., Div. U. C. C. Corp.	New York
Baker-Lull Corp.	Minneapolis
Baroid Sales Div., National Lead Co.	Chicago
Barrett Div., Allied Chemical & Dye Corp.	Toledo, Ohio
C. O. Bartlett & Snow Co.	Cleveland
Bay State Abrasive Prods. Co.	Westboro, Mass.
Beardsley & Piper Div., Pettibone Mulliken Corp.	Chicago
Bedford Tool & Forge Co.	Bedford, Ohio
Beryllium Corp.	Reading, Pa.
Black, Sivalls & Bryson, Inc.	Kansas City, Mo.
Blastcrete Service Co.	Los Angeles
Blaw-Knox Co.	Pittsburgh, Pa.
Bohn Aluminum & Brass Corp.	Detroit
Borden Co., Chemical Div.	New York
British Moulding Mach. Co., Ltd.,	Faversham, Kent, England
Brush Beryllium Co.	Cleveland
Buckeye Prods. Co.	Cincinnati
Buda Co.	Harvey, Ill.
Burgess-Sterbentz Corp.	Cleveland
Burr Oak Brass & Alum. Div., Keyes-Davis Co.	Burr Oak, Mich.
Campbell-Hausfeld Co.	Harrison, Ohio
Cambria Foundry & Engineering Div., Stevens Mfg. Co.	Ebensburg, Pa.
Canton Chaplet & Mfg. Co.	Canton, Ohio
Carl-Mayer Corp.	Cleveland
Centrifugal Casting Machine Co.	Tulsa, Okla.
Chain-Belt Co.	Milwaukee
Chicago Blower Corp.	Franklin Park, Ill.
Chicago Pneumatic Tool Co.	New York
Clark Eqpt. Co.	Battle Creek, Mich.
Clayton Sherman Abrasives Co.	Detroit
Clearfield Machine Co.	Clearfield, Pa.
Cleco Div., Reed Roller Bit Co.	Houston, Texas
Cleveland Flux Co.	Cleveland
Cleveland Metal Abrasive Co.	Cleveland
Cleveland Quarries Co.	Amherst, Ohio
Cleveland Vibrator Co.	Cleveland
Climax Molybdenum Co.	New York
Clino Foundry Supplies Ltd.	London, England
Colonial Metals Co.	Columbia, Pa.
Cone-Drive Gears Div., Michigan Tool Co.	Detroit
Corn Products Sales Co.	New York
Dant & Russell, Inc.	Portland, Oregon
Davenport Machine & Foundry Co.	Davenport, Iowa
Dayton Oil Co.	Dayton, Ohio
Dayton Pneumatic Tool Co.	Dayton, Ohio
Debevoise-Anderson Co., Inc.	New York
Delhi Foundry Sand Co.	Cincinnati
Delta Oil Products Co.	Milwaukee
Wm. Demmler & Bros.	Kewanee, Ill.
Detroit Electric Furnace Div., Kuhlman Elec. Co.	Bay City, Mich.
Harry W. Dietert Co.	Detroit
Dings Magnetic Separator Co.	Milwaukee
Joseph Dixon Crucible Co.	Jersey City, N. J.
DoALL Co.	Des Plaines, Ill.
Dougherty Lumber Co.	Cleveland
Dow Corning Corp.	Midland, Mich.
Dravo Corp.	Pittsburgh, Pa.
Durez Plastics & Chemicals, Inc.	No. Tonawanda, N. Y.
Eastern Clay Prods., Div., Intl. Minerals & Chem. Corp.	Chicago
Eastman Kodak Co.	Rochester, N. Y.
EIMCO Corp.	Chicago
Electric Controller & Mfg. Co.	Cleveland
Electro Metallurgical Co., Div. U. C. C. Corp.	New York
Electro Refractories & Abrasives Corp.	Buffalo, N. Y.
Euclid Foundry & Machine Eqpt. Co.	Cleveland
Exomet, Inc.	Conneaut, Ohio
Fabreeka Products Co.	Boston
Fanner Manufacturing Co.	Cleveland
Federal Foundry Supply Co.	Cleveland
Federated Metals Div., ASARCO	New York
FOUNDRY	Cleveland
Foundry Educational Foundation	Cleveland
Foundry Equipment Co.	Cleveland
Foundry Equipment Manufacturers Assn.	Cleveland
Foundry Facings Manufacturers Assn.	Pittsburgh, Pa.
Foundry Services, Inc.	New York
Fox Grinders, Inc.	Pittsburgh, Pa.
Freeman Supply Co.	Toledo, Ohio
Fremont Flask Co.	Fremont, Ohio
Gamma Industries, Inc.	Baton Rouge, La.
General Blower Co.	Morton Grove, Ill.
General Electric Co., Chemical Div.	Pittsfield, Mass.
Gerwin Industries, Inc.	Michigan City, Ind.
Girdler Co.	Louisville, Ky.
Gladwin Corp.	Wyandotte, Mich.
Globe Steel Abrasives Co.	Mansfield, Ohio
Glover Mfg. Co.	Meadville, Pa.
Claud S. Gordon Co.	Chicago
Gray Iron Founders' Society, Inc.	Cleveland
Great Lakes Carbon Corp.	St. Louis
Great Lakes Foundry Sand Co.	Detroit
A. P. Green Fire Brick Co.	Mexico, Mo.
Samuel Greenfield Co., Inc.	Buffalo, N. Y.
Grindle Corp.	Markham, Ill.
J. Hannan Co.	Cleveland
Harbison-Walker Refractories Co.	Pittsburgh, Pa.
Hardy Sand Co.	Evansville, Ind.
Harnischfeger Corp.	Milwaukee
Benjamin Harris & Co.	Chicago Heights, Ill.
Harrison Abrasives Div., Metals Disintegrating Co.	Elizabeth, N. Y.
Haylco Controls Corp.	Milwaukee
Hercules Powder Co.	Wilmington, Del.
Herman Pneumatic Machine Co.	Pittsburgh, Pa.
Hewitt-Robins, Inc.	Stamford, Conn.
Hickman, Williams & Co.	Cleveland
Hickory Specialty Co.	Hickory, N. C.
Hill & Griffith Co.	Cincinnati
Hines Flask Co.	Cleveland
Hoffman Foundry Supply	Cleveland
Frank G. Hough Co.	Libertyville, Ill.
E. F. Houghton & Co.	Philadelphia
Hydro-Blast Corp.	Chicago
Hydroway Scales, Inc.	Detroit
Illinois Clay Prod. Co.	Chicago
Induction Heating Corp.	Brooklyn, N. Y.
Industrial & Foundry Sales, Inc.	Eaton Rapids, Mich.
Industrial Silica Corp.	Youngstown, Ohio
Industrial X-Ray, Inc.	West Hempstead, N. Y.
Ingersoll-Rand Co.	New York
International Graphite & Electrode Div. Speer Carbon Co.	St. Marys, Pa.

International Molding Machine Co.	LaGrange Park, Ill.
International Nickel Co., Inc.	New York
Interstate Smelting & Refining Co.	Chicago
Iron Lung Ventilator Co.	Cleveland
Ironton Fire Brick Co.	Ironton, Ohio
Jaeger Machine Co.	Columbus, Ohio
Jeffrey Manufacturing Co.	Columbus, Ohio
Kindt-Collins Co.	Cleveland
Andrew King	Ardmore, Pa.
Lester B. Knight & Associates, Inc.	Chicago
H. Kramer & Co.	Chicago
Chas. A. Krause Milling Co.	Milwaukee
Kwik-Mix Co.	Milwaukee
Laboratory Eqpt. Corp.	St. Joseph, Mich.
Laclede-Christy Co.	St. Louis
Richard Lang	Detroit
Latrobe Steel Co.	Latrobe, Pa.
Lava Crucible-Refractories Co.	Pittsburgh, Pa.
R. Lavin & Sons, Inc.	Chicago
Lindberg Engineering Co.	Chicago
Linde Air Products Co., Div. Of U. C. C. Corp.	New York
Link-Belt Co.	Chicago
Lobdell United Co.	Wilmington, Del.
Machine Products Corp.	Detroit
Macklin Co.	Jackson, Mich.
Magie Bros, Inc.	Chicago
Magnaflux Corp.	Chicago
Manhattan Rubber Div., Raybestos-Manhattan, Inc.	Passaic, N. J.
Manley Sand Co.	Rockton, Ill.
Manning, Maxwell & Moore, Inc.	Muskegon, Mich.
Martin Engineering Co.	Kewanee, Ill.
Martindale Electric Co.	Cleveland
Maschinenfabrik & Eisengiesserei Kallnach	Kallnach, Switzerland
Master Pneumatic Tool Co., Inc.	Bedford, Ohio
J. S. McCormick Co.	Pittsburgh, Pa.
Mechanical Handling Systems, Inc.	Detroit
Meehanite Metal Corp. Croft Process Div.	New Rochelle, N. Y.
Merit Corp.	Milwaukee
Metal Blast, Inc.	Cleveland
Metallizing Company of America	Chicago
Metco Processing Corp.	Wyandotte, Mich.
Mine Safety Appliances Co.	Pittsburgh, Pa.
Modern Equipment Co.	Port Washington, Wis.
Monk Tool Co.	Geneva, Ill.
Monsanto Chemical Co.	St. Louis
The Moulders' Friend	Dallas City, Ill.
Nassau Smelting & Refining Co., Inc.	Staten Island, N. Y.
National Carbon Co,, Div. of U. C. C. Corp.	New York
National Crucible Co.	Philadelphia
National Engineering Co.	Chicago
National Foundry Association	Chicago
Newaygo Engineering Co.	Newaygo, Mich.
New Jersey Silica Sand Co.	Millville, N. J.
Niagara Falls Smelting & Refining Div. Continental Copper & Steel Ind., Inc.	Buffalo, N. Y.
Wm. H. Nicholls Co., Inc.	Richmond Hill, N. Y.
Nichols Engineering & Research Corp.	New York
Nock & Son Co.	Cleveland
Non-Ferrous Founders' Society	Chicago
North American Smelting Co.	Wilmington, Del.
Norton Co.	Worcester, Mass.
S. Obermayer Co.	Chicago
Ohio Crankshaft Co., Tocco Div.	Cleveland
Ohio Ferro Alloys Corp.	Canton, Ohio
Ohio Overall Cleaning Co.	Cleveland
Oliver Machinery Co.	Grand Rapids, Mich.
Orefraction, Inc.	Pittsburgh, Pa.
Osborn Manufacturing Co.	Cleveland
Pangborn Corp.	Hagerstown, Md.
Patternmaking Division, AFS	Cleveland-Chicago
Peerless Mineral Products Co.	Conneaut, Ohio
Pekay Machine & Engineering Co.	Chicago
Peninsular Grinding Wheel Co.	Detroit
Penn-Rillton Co.	New York
Penola Oil Co.	Detroit
Penton Publishing Co.	Cleveland
George F. Pettinos, Inc.	Philadelphia
Pittsburgh Crushed Steel Co. & Subsidiaries	Pittsburgh, Pa.
Pittsburgh Lectromelt Furnace Corp.	Pittsburgh, Pa.
PMS Co.	Cleveland
Porter-Cable Machine Co.	Syracuse, N. Y.
Precision Grinding Wheel Co., Inc.	Philadelphia
Pyrometer Instrument Co., Inc.	Bergenfield, N. J.
Ready-Power Co.	Detroit
Redford Iron & Eqpt. Co.	White Plains, N. Y.
Reichhold Chemicals, Inc.	Cleveland
Reynolds Metals, Inc.	Louisville, Ky.
River Smelting & Refining Co.	Cleveland
H. H. Robertson Co.	Pittsburgh, Pa.
Robinson Clay Prods. Co.	Akron, Ohio
Roessing Bronze Co.	Pittsburgh, Pa.
Ross Operating Valve Co.	Detroit
Rossborough Supply Co.	Cleveland
Ross-Tacony Crucible Co.	Philadelphia
Rotor Tool Co.	Cleveland
Royer Foundry & Machine Co.	Kingston, Pa.
Safety Clothing & Equipment Co.	Cleveland
Safety, Hygiene & Air Pollution, AFS	Chicago
Sand Products Corp.	Cleveland
Sawyer Bailey Corp.	Buffalo, N. Y.
Claude B. Schneible Co.	Detroit
A. Schrader's Son, Div. of Scovill Mfg. Co.	Brooklyn, N. Y.
Schramm, Inc.	West Chester, Pa.
I. Schumann & Co.	Cleveland
Scientific Cast Prods. Corp.	Cleveland
Semet-Solvay Div., Allied Chem. & Dye Corp.	New York
Shalco Engineering Corp.	Connellsville, Pa.
Shallway Corp.	Connellsville, Pa.
Shell-O-Matic, Inc.	Irvington, N. J.
Simonds Abrasive Co.	Philadelphia
Simplicity Engineering Co.	Durand, Mich.
Sipi Metals Corp.	Chicago
Smith Facing & Supply Co.	Cleveland
Smith Oil & Refining Co.	Rockford, Ill.
Smith & Richardson Mfg. Co.	Geneva, Ill.
Solvay Process Div., Allied Chemical & Dye Corp.	New York
Southern Shell Mold Eqpt. Co.	Chattanooga, Tenn.
Specialty Prods. Co.	Jersey City, N. J.
Spencer Turbine Co.	Hartford, Conn.
SPO, Inc.	Cleveland
Springfield Pattern Works, Inc.	Springfield, Mass.
Standard Electrical Tool Co.	Cincinnati
Standard Horse Nail Corp.	New Brighton, Pa.
STEEL	Cleveland
Steel Founders' Society of America	Cleveland
Steel Shot Producers, Inc.	Butler, Pa.
Steelblast Abrasives Co.	Cleveland
Sterling Abrasives Div., Cleveland Quarries Co.	Tiffin, Ohio
Sterling Wheelbarrow Co.	Milwaukee
Frederic B. Stevens, Inc.	Detroit
Stroman Furnace & Eng. Co., Div. Petersen Oven Co.	Irvington, N. J.
Sutter Prods. Co.	Dearborn, Mich.
Swan-Finch Oil Corp.	New York
Tabor Mfg. Co.	Philadelphia
Taggart Brimfield Co.	Hammonton, N. J.
Technical Operations, Inc.	Arlington, Mass.
G. H. Tennant Co.	Minneapolis
Thiem Prods., Inc.	Milwaukee
Thor Power Tool Co.	Aurora, Ill.
Titanium Alloy Mfg. Div., National Lead Co.	New York
Toledo Scale Co.	Toledo, Ohio
Tractomotive Corp.	Deerfield, Ill.
Tyler Metal Prods. Co.	St. Louis
Union Carbide & Carbon Corp.	New York
United Oil Manufacturing Co.	Erie, Pa.
United States Gypsum Co.	Chicago
United States Hoffman Machinery Corp.	New York
United States Reduction Co.	East Chicago, Ind.
Vacu-Blast Co., Inc.	Belmont, Calif.
Vanadium Corp. of America	New York
Vesuvius Crucible Co.	Pittsburgh, Pa.
Vibron Div., Burgess-Sterbentz Corp.	Cleveland
Westover Engineers	Milwaukee
Whitehead Brothers Co.	New York
White Pine Lumber Co.	Chicago
Whiting Corp.	Harvey, Ill.
Williston and Co.	Delta, Ohio
Wood Fabricating Co.	Dearborn, Mich.



Saturday, May 8

9 am

Registration Opens

9:30 am

Exhibits Open
Northeastern Ohio Day
(Free admission for local plant employees)

5:30 pm

Registration Closes
Exhibits Close

Sunday, May 9

Exhibits Closed All Day
No Technical Sessions

Monday, May 10

9 am

Registration Opens

9:30 am

Exhibits Open

**Indicates issue of* AMERICAN FOUNDRYMAN *where paper preprinted.*

10 am

Brass and Bronze

PRESIDING: H. J. Roast, Consultant, Ottawa, Canada.
VICE-CHAIRMAN: R. A. Colton, Federated Metals Div., American Smelting & Refining Co., Barber, N. J.
SECRETARY: T. E. Gregory, Michigan Smelting & Refining Div., Bohn Aluminum Corp., Detroit.

(April issue)*

Ornamental Yellow Brass Castings Gated for Greater Economy
C. L. Mack, Chautauqua Hardware Corp., Jamestown, N. Y.

(Preprint 54-79)

Some Experiences in the Shell Molding of Copper-Base Alloys
S. S. Brown and H. K. Worner, Shellmould Div., W. O. & B. Adams Pty., Ltd., Melbourne, Australia—(Presented by B. N. Ames, Doran Manganese Bronze Corp., Brooklyn, N. Y.).

Light Metals

PRESIDING: R. T. Wood, Aluminum Co. of America, Pittsburgh, Pa.
VICE-CHAIRMAN AND SECRETARY: W. Danks, Howard Foundry Co., Chicago.

(April-May issues)*

Gating and Risering of Magnesium Alloys
H. E. Elliott, Dow Chemical Co., Bay City, Mich.

(Preprint 54-23)

Segregation in Magnesium—Rare Earth—Zinc—Zirconium Alloys
H. M. Skelly, Aluminum Laboratories, Ltd., Kingston, Ont., Canada, and D. C. Sunnucks, Aluminum Co. of Canada, Ltd., Montreal, Canada.

Beryllium in Magnesium Die Casting Alloys
F. L. Burkett, Dow Chemical Co., Midland, Mich.

Malleable

PRESIDING: R. V. Osborne, Lakeside Malleable Castings Co., Racine, Wis.
VICE-CHAIRMAN AND SECRETARY: H. C. Stone, Belle City Malleable Iron Co., Racine, Wis.

(Preprint 54-68)

On the Effect of Plastic Deformation of Hard Iron on Subsequent Annealing
W. K. Bock, National Malleable & Steel Castings Co., Cleveland.

The Prebaking Effect in Malleablizing
Floyd Brown, North Carolina State College, Raleigh, N. C.

12 Noon

Light Metals Round Table Luncheon

PRESIDING: W. E. Sicha, Aluminum Co. of America, Cleveland.
VICE-CHAIRMAN: R. F. Thomson, General Motors Research Laboratories, Detroit.

The Principles of Vertical Gating
Progress Report, AFS Light Metals Research, J. G. Kura, Battelle Memorial Institute, Columbus, Ohio.

(Preprint 5-37)

Transparent Plastic Mold Models for Study of Fluid Flow Characteristics in Investment Molds
D. G. McCullough, F. J. Webbere, and R. F. Thomson, General Motors Research Laboratories, Detroit.

CONVENTION PROGRAM

and Program Personalities

2 pm

Brass and Bronze

PRESIDING: F. L. Riddell, H. Kramer & Co., Chicago.
VICE-CHAIRMAN: A. W. Bardeen, Ohio Brass Co., Mansfield, Ohio.
SECRETARY: D. G. Schmidt, H. Kramer & Co., Chicago.

Research in Progress:

Research in Progress for the Bureau of Ships, Dept. of the Navy
W. H. Baer, Bureau of Ships, Navy Dept., Washington, D. C.

Valve Stem Dezincification
R. H. Hanlon, Kennedy Valve Mfg. Co., Elmira, N. Y.

Pressure Molding for Copper-Base Alloys
T. E. Barlow, Eastern Clay Products Dept., International Minerals & Chemical Corp., Chicago.

Melt Quality for Bronze Alloys
H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.

Pattern

PRESIDING: E. T. Kindt, Kindt-Collins Co., Cleveland.
VICE-CHAIRMAN: G. E. Garvey, City Pattern & Foundry Co., South Bend, Ind.

(Preprint 54-52)

Investment Casting by the Frozen Mercury Process
I. R. Kramer, Mercast Corp., New York.

Blow-In Driers
Robert W. Wendt, Industrial Pattern & Mfg. Co., Inc., Chicago.

Malleable

PRESIDING: W. A. Kennedy, Grinnell Co., Inc., Providence, R. I.
VICE-CHAIRMAN AND SECRETARY: G. B. Mannweiler, Eastern Malleable Iron Co., Naugatuck, Conn.

(Preprint 54-50)

Some Effects of Melting Furnace Atmospheres on Tensile Properties and Annealability of Malleable Iron
Progress Report, AFS Malleable Research, R. W. Heine, University of Wisconsin, Madison.

W. A Snyder

T. E. Barlow

R. F. Dalton

C. M. Adams, Jr.

Strength of Some White Irons in the Temperature Range of Hot Tearing
J. P. Frenck and R. W. Heine, University of Wisconsin, Madison.

3 pm

Official AFS Ladies' Tea

4 pm

Brass and Bronze Shop Course

PRESIDING: M. G. Dietl, Schaible Co., Cincinnati.
VICE-CHAIRMAN: A. E. Jacobson, Jr., Grand Haven Brass Co., Grand Haven, Mich.

CONVENTION. *Program*

R. W. Heine

B. C. Yearley

C. A. Sanders

R. G. Powell

Jules Henry

G. J. Grott

Core Boxes, Ovens and Driers
Robert W. Wendt, Industrial Pattern Works, Chicago.
Core Ovens
C. H. Barnett, Foundry Equipment Co., Cleveland.

Light Metals

PRESIDING: D. L. LaVelle, American Smelting & Refining Co., South Plainfield, N. J.
VICE-CHAIRMAN AND SECRETARY: F. P. Strieter, Die Casting Div., Dow Chemical Co., Midland, Mich.

New Aluminum Die Casting Alloys
D. L. Colwell and E. Trela, Apex Smelting Co., Cleveland. (Preprint 54-24)

Mechanical Properties of Aluminum Die Casting Alloys
C. O. Smith, Aluminum Research Laboratories, Aluminum Co. of America, New Kensington, Pa. (Preprint 54-29)

Some Factors Affecting Fatigue Strength of Aluminum Alloy Sand Castings
Marshall Holt, Aluminum Research Laboratories, Aluminum Co. of America, New Kensington, Pa.

Malleable Shop Course

PRESIDING: Milton Tilley, National Malleable & Steel Castings Co., Cleveland.
VICE-CHAIRMAN: W. M. Albrecht, Chain Belt Co., Milwaukee.

Melting Malleable Iron:
Cupola Melting Fundamentals
R. W. Heine, University of Wisconsin, Madison.
Cupola Melting at Belle City Malleable
Frank Lapour, Belle City Malleable Iron Co., Racine, Wis.
Cupola Melting at Auto Specialties
R. H. Greenlee, Auto Specialties Mfg. Co., St. Joseph, Mich.

5:30 pm

Registration Closes
Exhibits Close

President's Reception and International Reunion
(By invitation)

6:15 pm

Non-Ferrous Founders' Society
Annual Dinner

8 pm

Gray Iron Shop Course

PRESIDING: H. H. Wilder, Vanadium Corp. of America, Detroit.

VICE-CHAIRMAN: E. J. Burke, Hanna Furnace Corp., Buffalo, N. Y.

Coke Screening and Its Relation to Cupola Operation

DISCUSSION LEADER: W. W. Holden, Eaton Mfg. Co., Vassar, Mich.

Sand Shop Course

PRESIDING: R. H. Olmsted, Whitehead Brothers Co., Conneaut, Ohio.

VICE-CHAIRMAN: Robert Frederickson, Central Foundry Div., General Motors Corp., Saginaw, Mich.

Fundamentals of Sand Control

MODERATOR: C. A. Sanders, American Colloid Co., Chicago.

PANEL MEMBERS:

D. L. LaVelle, American Smelting & Refining Co., South Plainfield, N. J.

C. A. Robeck, Gibson & Kirk Co., Baltimore, Md.

Eric Welander, John Deere Malleable Works, East Moline, Ill.

Tuesday, May 11

9 am

Registration Opens

9:30 am

Exhibits Open

10 am

Brass and Bronze

PRESIDING: H. L. Smith, Federated Metals Div., American Smelting & Refining Co., Pittsburgh, Pa.

VICE-CHAIRMAN: R. J. Sahm, Jr., Lava Crucible-Refractories Co., Chicago.

SECRETARY: H. C. Ahl, Jr., Down River Casting Co., Rockwood, Mich.

(Preprint 54-21)

Application of Chills to Improving the Pressure Tightness of Gun Metal (88-8-4)

W. H. Johnson, H. F. Bishop, and W. S. Pellini, Metallurgy Division, Naval Research Laboratory, Washington, D. C.

Some Factors Affecting Metal Penetration of Navy "M" Bronze in Cores

R. B. Fischer, Ingersoll-Rand Co., Phillipsburg, N. J.

Light Metals

PRESIDING: R. F. Cramer, General Electric Co., Schenectady, N. Y.

VICE-CHAIRMAN AND SECRETARY: K. B. Bly, Fabricast Div., General Motors Corp., Bedford, Ind.

(Preprint 54-70)

Effect of Centrifugal Force on the Structure and Mechanical Properties of Aluminum Casting Alloy C4

O. Z. Rylski, A. Couture, and J. W. Meier, Dept. of Mines & Technical Surveys, Ottawa, Ont., Can.

Techniques for Improving the Strength and Ductility of Aluminum Alloy Castings

W. D. Walther, C. M. Adams, and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.

Malleable

PRESIDING: W. D. McMillan, International Harvester Co., Chicago.

VICE-CHAIRMAN AND SECRETARY: R. A. Schneidewind, University of Michigan, Ann Arbor, Mich.

The Graphitization of Rims in Malleable Iron

H. A. Schwartz and J. D. Hedberg, National Malleable & Steel Castings Co., Cleveland.

The Effect of Atmospheres on the Rate of Anneal of Black Heart Malleable Iron

J. E. Rehder, Canada Iron Foundries, Ltd., Montreal, Que., Can.

Pattern

PRESIDING: Vaughan C. Reid, City Pattern Foundry & Machine Co., Detroit.

VICE-CHAIRMAN AND SECRETARY: J. W. Costello, American Hoist & Derrick Co., St. Paul, Minn.

Pattern Equipment for Shell Molding

O. C. Bueg, Arrow Pattern & Engineering Co., Erie, Pa.

Use of Plastics in Pattern Making

W. C. H. Dunn, Western Pattern Works, Inc., Montreal, Que., Can.

Industrial Engineering

PRESIDING: J. J. Farkas, Cincinnati Milling Machine Co., Cincinnati.

VICE-CHAIRMAN AND SECRETARY: Dean Van Order, Burnside Steel Foundry Co., Chicago.

(Preprint 54-33)

Time Distance Charts—Analysis of Work Content, Time, Distance and Speed at Conveyor Stations

H. W. Bielefeld, Ford Motor Co. of Canada, Ltd., Windsor, Ont., Can.

(Preprint 54-16)

Educating Management to a Valuable Tool

John Taylor, Griffenhagen and Associates, Inc., Chicago. (To be presented by E. W. Noakes, Lester B. Knight & Associates, Inc., Chicago).

W. H. Johnson

F. L. Burkett

J. H. Hoke

F. A. Brandt

R. E. Edelman

E. C. Ashley

CONVENTION *Program*

[illegible]erger

G. H. Schippereit

C. F. Walton

O. W. Simmons

R. B. Fischer

R. H. Jacoby

12 Noon

Brass and Bronze Round Table Luncheon

PRESIDING: B. A. Miller, Crown Non-Ferrous Foundry, Inc., Chester, Pa.
VICE-CHAIRMAN: H. L. Smith, Federated Metals Div., American Smelting & Refining Co., Pittsburgh, Pa.
Toward Improved Foundry Practice

Education Division Round Table Luncheon

PRESIDING: W. J. Hebard, Continental Foundry & Machine Co., East Chicago, Ind.
VICE-CHAIRMAN: W. H. Ruten, Polytechnic Institute of Brooklyn, N. Y.
Human Engineering
B. C. Yearley, National Malleable & Steel Castings Co., Cleveland.

Malleable Round Table Luncheon

PRESIDING: J. H. Lansing, Malleable Founders' Society, Cleveland.
Effective Use of Melting Controls in Duplex and Direct Furnace Melting

SPEAKERS: L. E. Emery, Marion Malleable Iron Co., Marion, Ind.
E. T. Price, Cadillac Malleable Iron Co., Cadillac, Mich.

Sand Round Table Luncheon

PRESIDING: F. S. Brewster, Harry W. Dietert Co., Detroit.
VICE-CHAIRMAN: O. J. Myers, Archer-Daniels-Midland Co., Minneapolis.
What's in the Future

2 pm

Light Metals

PRESIDING: O. W. Simmons, Rem-Cru Titanium, Inc., Midland, Pa.
VICE-CHAIRMAN AND SECRETARY: Paul Frost, Battelle Memorial Institute, Columbus, Ohio.

(Preprint 54-36)
A Bottom-Pour, Arc-Type Furnace for the Melting and Casting of Titanium

O. W. Simmons, Rem-Cru Titanium Corp., H. R. McCurdy and R. E. Edelman, Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia.

Mechanical Properties of Cast Titanium-Aluminum Alloys
R. E. Edelman and A. Tabak, Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia.
(Preprint 54-25)

Expendable Molds for Titanium Castings
R. M. Lang, J. Gissy, G. H. Schippereit, and J. G. Kura, Battelle Memorial Institute, Columbus, Ohio.
(This issue)

Techniques for Producing Titanium Alloy Castings
M. Glassenberg and M. J. Berger, Armour Research Foundation, Chicago.

Education

PRESIDING: F. W. Shipley, Caterpillar Tractor Co., Peoria, Ill.
VICE-CHAIRMAN: W. F. Graden, Simonds Abrasive Co., Philadelphia.
SECRETARY: J. J. De Hart, Lynchburg Foundry Co., Lynchburg, Va.

Developing All Levels of Management
D. F. Lane, National Foreman's Institute, Inc., New York.

A Short Course in Foundry Skills
Arthur Agostini, Grede Foundries, Inc., Milwaukee.

Plaster Mold Casting

PRESIDING: H. Rosenthal, Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia.
VICE-CHAIRMAN AND SECRETARY: G. R. Gardner, Cleveland Research Div., Aluminum Co. of America, Cleveland.

Improving the Thermal Conductivity and Economy of Foam Plaster Molds
R. F. Dalton, Hills-McCanna Co., Chicago.

Some Practical Applications for Expansion Plaster
Otto Harer, Scientific Cast Products Corp. of Illinois, Chicago.

History and Development of Plaster Mold Castings
K. A. Miericke, Baroid Sales Div., National Lead Co., Chicago.

Dust Control and Ventilation

PRESIDING: R. S. Dahmer, Eaton Mfg. Co., Vassar, Mich.
VICE-CHAIRMAN: W. W. Dodge, Caterpillar Tractor Co., Peoria, Ill.
SECRETARY: A. S. Lundy, Claude B. Schneible Co., Detroit.

Helpful Hints on Foundry Dust and Ventilation Control

Progress Report—AFS Safety, Hygiene & Air Pollution Control Program
J. R. Allan, International Harvester Co., Chicago.

Foundry Hygiene Problems
H. J. Weber, American Brake Shoe Co., Chicago.

Principles of Foundry Ventilation
(Demonstration) B. B. Bloomfield, Div. of Occupational Health, Michigan Department of Health, Lansing.

Principles of Exhaust Ventilation
W. W. Dodge, Caterpillar Tractor Co., Peoria, Ill.

Ventilation of Sand Handling Equipment
F. C. Fluegge, International Harvester Co., Chicago.

Cooling of Castings
T. J. Glaza, Crane Co., Chicago.

Principles of Effective Maintenance of Foundry Ventilation and Dust Collecting Equipment
K. M. Smith, Caterpillar Tractor Co., Peoria, Ill.

Industrial Engineering

PRESIDING: C. J. Pruet, McWane Cast Iron Pipe Co., Birmingham, Ala.
VICE-CHAIRMAN AND SECRETARY: R. E. Evert, Eaton Mfg. Co., Foundry Div., Vassar, Mich.
(Preprint 54-47)

An Incentive Plan for "Line" Supervisors
E. D. Bolden, Westover Engineers, Milwaukee.

A Measured Daywork Program (Preprint 54-39)
L. W. Lehmann, John Deere Van Brunt Co., Horicon, Wis.

4 pm

Brass & Bronze Shop Course

PRESIDING: M. G. Dietl, Schaible Co., Cincinnati.
VICE-CHAIRMAN: A. E. Jacobson, Jr., Grand Haven Brass Co., Grand Haven, Mich.

Developments in Core Making:

Practical Know-How of Core Blowing and Machine Maintenance
G. E. Miller, Osborn Mfg. Co., Cleveland.

C. W. Briggs

H. R. McCurdy

R. Carlson

J. W. Meier

S. F. Carter

C. Wenninger

Oil Bonded and Resin Bonded Cores
W. B. Bishop, Archer-Daniels-Midland Co., Cleveland.

Malleable Shop Course

PRESIDING: Eric Welander, John Deere Malleable Works, East Moline, Ill.
VICE-CHAIRMAN: Wm. Zeunik, National Malleable & Steel Castings Co., Indianapolis.

Malleable Annealing Practice
PANEL MEMBERS:
J. T. Bryce, Albion Malleable Iron Co., Albion, Mich.
F. W. Jacobs, Texas Foundries, Inc., Lufkin, Texas.
L. R. Jenkins, Wagner Malleable Iron Co., Decatur, Ill.

Education

PRESIDING: F. G. Sefing, International Nickel Co., New York.
VICE-CHAIRMAN: E. M. Strick, Erie Malleable Iron Co., Erie, Pa.

CONVENTION *Program*

A. B. Dieti

G. Vennerholm

E. T. Myskowski

D. L. Colwell

J. P. Frenck

C. C. Sigerfoos

SECRETARY: G. J. Barker, University of Wisconsin, Madison.

Panel Discussion—What Does the Foundry Industry Want AFS to Do in Educational Work on the Local Chapter Level?

PANEL MEMBERS:

R. M. Reese, Supervisor of Trade and Industrial Education, State of Ohio, Columbus, Ohio.

H. E. Mandel, Pennsylvania Foundry Supply and Sand Co., Philadelphia.

E. M. Strick, Erie Malleable Iron Co., Erie, Pa.

B. C. Yearley, National Malleable & Steel Castings Co., Cleveland.

A. B. Sinnett, American Foundrymen's Society, Chicago.

5:30 pm

Registration Closes
Exhibits Close

6 pm

Canadian Dinner

PRESIDING: G. Ewing Tait, Dominion Engineering Works, Montreal, Canada.

8 pm

Gray Iron Shop Course

PRESIDING: K. H. Priestley, Vassar Electroloy Products, Inc., Vassar, Mich.

VICE-CHAIRMAN: L. L. Clark, Armour Research Foundation, Chicago.

Gating to Control Pouring Rate and Its Effect on Casting Quality

DISCUSSION LEADER: F. J. McDonald, Central Foundry Div., General Motors Corp., Saginaw, Mich.

ALT. DISCUSSION LEADER: C. B. Stone, Lynchburg Foundry Co., Lynchburg, Va.

Sand Shop Course

PRESIDING: F. S. Brewster, Harry W. Dietert Co., Detroit.

VICE-CHAIRMAN: R. H. Jacoby, Key Co., East St. Louis, Ill.

Fundamentals of Sand Control

MODERATOR: C. A. Sanders, American Colloid Co., Chicago.

PANEL MEMBERS:

W. R. Jennings, John Deere Tractor Co., Waterloo, Iowa.

L. E. Wile, Lynchburg Foundry Co., Lynchburg, Va.

John Clarke, General Electric Co., Erie, Pa.

Wednesday, May 12

8:30 am

National Castings Council
Annual Meeting

9 am

Registration Opens

9:30 am

AFS Annual Business Meeting

PRESIDING: AFS National President Collins L. Carter.

President's Annual Address

Apprentice Contest Awards

Election of Officers and Directors

Charles Edgar Hoyt Annual Lecture—The Processing of Molding Sands
Harry W. Dietert, Harry W. Dietert Co., Detroit.

12 Noon

Exhibits Open

Gray Iron Round Table Luncheon

PRESIDING: J. S. Vanick, International Nickel Co., New York.
SPEAKERS:
L. N. Shannon, Stockham Valves & Fittings, Inc., Birmingham, Ala.
High Lights of Our European Trip
J. E. Rehder, Canada Iron Foundries, Ltd., Montreal, Que., Can.
European Metallurgy and Melting Practice
F. M. Kulka, Motor Castings Co., Milwaukee.
European Molding, Core Making and Production Equipment

Pattern Round Table Luncheon

PRESIDING: A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee.
VICE-CHAIRMAN: H. J. Jacobson, Industrial Pattern Works, Chicago.
Accuracy and Tolerances for Patterns
George Webber, Webber Gage Co., Cleveland.
Panel Discussion—Pattern Development and Problems
(Question and Answer Period)

2 pm

Steel

PRESIDING: C. H. Wyman, Burnside Steel Foundry Co., Chicago.
VICE-CHAIRMAN: J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind.
Hot Tearing of Steel Castings:
(Preprint 54-78)
The Stress Required to Hot Tear Plain Carbon Cast Steel: Effects of Tearing Temperature, Composition and Deoxidation Practice
H. K. Bhattacharya, C. M. Adams, Jr., and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.

John Taylor

J. M. Crockett

S. L. Gertsman

H. W. Lownie

H. Rosenthal

R. Schneidewind

Influence of Core Material on Hot Tearing of Steel Castings
Progress Report, AFS Steel Research Committee.
C. H. Wyman, Chairman, Burnside Steel Foundry Co., Chicago.
Report on Metallurgical Investigation at Armour Research Foundation
L. L. Clark, Armour Research Foundation, Chicago.

Panel Discussion:
H. H. Blosjo, Minneapolis Electric Steel Castings Co., Minneapolis.
J. B. Caine, Consultant, Cincinnati.
B. A. Lawson, Harrison Steel Castings Co., Attica, Ind.
Charles Locke, West Michigan Steel Castings Co., Muskegon, Mich.
W. S. Pellini, Naval Research Laboratory, Washington, D. C.
J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind.
C. M. Adams, Jr., Massachusetts Institute of Technology, Cambridge, Mass.
C. J. Zilch, Bucyrus-Erie Co., South Milwaukee, Wis.
D. C. Zuege, Sivyer Steel Casting Co., Milwaukee.

Sand

PRESIDING: E. L. Buchman, Ford Motor Co., Cleveland Foundry Div., Cleveland.
VICE-CHAIRMAN: T. A. Tarquinio, American Manganese Steel Div., American Brake Shoe Co., Chicago Heights, Ill.
SECRETARY: T. Giszczak, Central Foundry Div., General Motors Corp., Defiance, Ohio.
(Preprint 54-59)
Another Look at Sand Grain Distribution
B. H. Booth, Carpenter Brothers, Inc., Milwaukee, and C. A. Sanders, American Colloid Co., Chicago.
Fundamentals Make Better Castings
L. L. Clark, Armour Research Foundation, Chicago.
(Preprint 54-53)
Zircon Sands — Occurrence and Uses in Australian Industry
Official Exchange Paper, Institute of Australian Foundrymen, New South Wales Div.
Paul Markwell, McLean Castings, Ltd., Sydney, Australia.

Heat Transfer

PRESIDING: H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland.

CONVENTION

Program

J. A. Barkas

F. J. Webbere

W. D. McMillan

F. W. Shipley

C. T. Marek

W. C. Jeffery

VICE-CHAIRMAN AND SECRETARY: F. T. McGuire, Deere & Co., Moline, Ill.

Solidification of Finite Cylinders (Preprint 54-31)

AFS Heat Transfer Research Progress Report
V. Paschkis, Columbia University, New York.
(April issue)

Heat Transfer Characteristics of Shell Molds
R. E. Morey, H. F. Bishop, and W. S. Pellini, Naval Research Laboratory, Washington, D. C.
(Preprint 54-62)

Solidification of Various Metals in Sand and Chill Molds
F. A. Brandt, H. F. Bishop, and W. S. Pellini, Naval Research Laboratory, Washington, D. C.

Refractories

PRESIDING: W. R. Jaeschke, Whiting Corp., Harvey, Ill.
VICE-CHAIRMAN AND SECRETARY: R. A. Witschey, A. P. Green Fire Brick Co., Chicago.

Economic Considerations in Refractory Ladle Practice
J. H. Rickey, Jr., Ironton Fire Brick Co., Ironton, Ohio.
(Preprint 54-55)

Correlation of Air Furnace Bottom Temperature to Refractory and Operating Practice in a Cupola-Air Furnace Duplex System—Part II
F. W. Jacobs and E. C. Ashley, Texas Foundries, Inc., Lufkin, Texas.

4 pm

Plant & Plant Equipment

PRESIDING: James Thomson, Continental Foundry & Machine Co., East Chicago, Ind.
VICE-CHAIRMAN AND SECRETARY: H. W. Johnson, Wells Mfg. Co., Skokie, Ill.
(Preprint 54-49)

The Development of Cupola Melting Equipment
W. R. Jaeschke, Whiting Corp., Harvey, Ill.

Cupola Dust Collectors
D. E. Gilchrist, Deere & Co., Moline, Ill.

Gray Iron

PRESIDING: K. H. Priestley, Vassar Electroloy Products, Inc. Vassar, Mich.
VICE-CHAIRMAN AND SECRETARY: W. C. Jeffery, University of Alabama, University, Ala.

Studies on the Machinability and Microstructure of Cast Irons
E. A. Loria, Carborundum Co., Niagara Falls, N. Y.

The Machining Characteristics of Cast Irons
Michael Field and J. F. Kahles, Metcut Research Associates, Cincinnati.
(April issue)

Fluidity vs. Core Blows in Automotive Gray Iron
A. A. Evans, International Harvester Co., Indianapolis.

Safety in the Foundry

PRESIDING: J. W. Young, International Harvester Co., Chicago.
VICE-CHAIRMAN AND SECRETARY: P. W. Olson, Eaton Mfg. Co., Foundry Div., Vassar, Mich.

Value of the Safety Program to the Foundry
E. C. Hoenicke, Eaton Mfg. Co., Foundry Div., Detroit, Mich.

The Camera Aids Our Housekeeping & Inspection Program
Harold Zuehlke, Allis-Chalmers Mfg. Co., Milwaukee.

Training in Accident Prevention
T. A. Kraklow, Deere & Co., Moline, Ill.

Protective Equipment
R. L. Berger, Belle City Malleable Iron Co., Racine, Wis.

Engineering Safety Into New Methods
(film and narration)
R. V. Righter, Central Foundry Div., General Motors Corp., Danville, Ill.

Round Table Discussion—What's the Big Problem in Your Safety Program?

Sand

PRESIDING: John Perkins, Ford Motor Co. of Canada, Ltd. Windsor, Ont., Canada.
VICE-CHAIRMAN: F. W. Jacobs, Texas Foundries, Inc., Lufkin, Texas.
SECRETARY: J. S. Schumacher, Hill & Griffith Co., Cincinnati.

(March issue)

Casting Quality and Related to the pH Value of Molding Sands
G. J. Grott, Unitcast Corp., Toledo, Ohio.

(Preprint 54-34)

Food for Thought: What is Basic to the Selection and Mulling of Synthetic Sands?
C. E. Wenninger, National Engineering Co., Chicago.

(This issue)

Pre-Mixing of Reconditioning Materials for Molding Sand
Burdette Jones, John Deere Waterloo Tractor Works, Waterloo, Iowa.

5:30 pm

Registration Closes
Exhibits Close

7 pm

Annual Banquet

PRESIDING: Collins L. Carter, President, American Foundrymen's Society.

Presentation of AFS Gold Medal Awards and Honorary Life Memberships

Entertainment Program

Thursday, May 13

9 am

Registration Opens

AFS Past Presidents' Breakfast
(Past Presidents only)
PRESIDING: Walter L. Seelbach, Superior Foundry, Inc., Cleveland.

9:30 am

Exhibits Open

10 am

Gray Iron

PRESIDING: F. T. McGuire, Deere & Co., Moline, Ill.
VICE-CHAIRMAN AND SECRETARY: R. A. Flinn, Jr., University of Michigan, Ann Arbor.

(Preprint 54-6)

The Theoretical Aspects of Oxygen in Cast Iron
B. B. Bach, British Cast Iron Research Association, Birmingham, England.

(Preprint 54-22)

Some Variables in Acid Cupola Melting
S. F. Carter and Ralph Carlson, American Cast Iron Pipe Co., Birmingham, Ala.

(This issue)

The Melting of Cast Iron Borings and Steel Turnings in the Cupola
Official Exchange Paper, Institute of British Foundrymen
Wm. Y. Buchanan, John Lang & Sons, Ltd., Johnstone, Renfrewshire, Scotland.

Sand

PRESIDING: C. E. Maddick, Massey-Harris Co., Ltd., Brantford, Ont., Can.
VICE-CHAIRMAN: C. W. Schwenn, Brillion Iron Works, Inc., Brillion, Wis.
SECRETARY: R. G. Reiff, Ford Motor Co., Dearborn, Mich.

(This issue)

Recent Developments in Shell Molding
E. I. Valyi, A.R.D. Corp., Yonkers, N. Y.

(Preprint 54-44)

Pressure Molding with Standard Synthetic Sands
T. E. Barlow and W. R. Adams, Eastern Clay Products Dept., International Minerals & Chemical Corp., Chicago.

Research on Shell Molding (Preprint 54-45)
R. G. Powell, C. M. Adams, Jr. and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.

B. H. Booth

H. F. Taylor

F. S. Brewster

C. W. Wyman

R. A. Flinn

R. H. Olmsted

Steel

PRESIDING: J. R. Patton, General Steel Castings Corp., Granite City, Ill.
VICE-CHAIRMAN AND SECRETARY: J. H. Janssen, Pratt & Letchworth, Buffalo, N. Y.

(April issue)

Effect of Pouring Temperature on the Soundness and Physical Properties of Steel Castings
C. F. Christopher, Continental Foundry & Machine Co., East Chicago, Ind.

Why Did It Fail? (Preprint 54-58)
M. V. Herasimchuk, Bethlehem Steel Co., Bethlehem, Pa.

Heat Transfer

PRESIDING: E. C. Troy, Foundry Engineer, Palmyra, N. J.
VICE-CHAIRMAN AND SECRETARY: J. B. Caine, Foundry Consultant, Cincinnati.

A. F. Pfeiffer

C. Locke

D. C. Williams

(Preprint 54-61)

Heat Transfer of Various Molding Material for Steel Castings
Charles Locke, West Michigan Steel Casting Co., Muskegon, Mich., and C. W. Briggs, Steel Founders' Society of America, Cleveland.

Studies of Chill Action (Preprint 54-64)
E. T. Myskowski, H. F. Bishop, and W. S. Pellini, Naval Research Laboratory, Washington, D. C.

12 Noon

AFS Board of Directors Luncheon
(Members of Board only)

Steel Round Table Luncheon

PRESIDING: V. E. Zang, Unitcast Corp., Toledo, Ohio.

2 pm

Air Pollution Control

PRESIDING: F. A. Patty, General Motors Corp., Detroit.
VICE-CHAIRMAN AND SECRETARY: K. M. Smith, Caterpillar Tractor Co., Peoria, Ill.

(Preprint 54-83)

Experiences with the Use of a Spray Type Collector on a 72-in. Cupola
A. G. Tompkins, Lufkin Foundry & Machine Co., Lufkin, Texas.

Cupola Fly-Ash Suppression (Preprint 54-82)
R. M. Ovestrud, Minneapolis-Moline Co., Minneapolis.

Cupola Emission Control
Otto Brechtelsbauer, Chevrolet Gray Iron Foundry, General Motors Corp., Saginaw, Mich.

Control of Emissions for the Electric Furnace
L. Krueger, Pelson Steel Casting Co., Milwaukee.

Round Table Discussion

Refractories Shop Course

PRESIDING: R. H. Stone, Vesuvius Crucible Co., Pittsburgh, Pa.
VICE-CHAIRMAN: W. R. Jaeschke, Whiting Corp., Harvey, Ill.

The Importance of Refractories in Your Foundry
PANEL MEMBERS:
Ralph Carlson, American Cast Iron Pipe Co., Birmingham, Ala.
R. H. Jacoby, Key Co., East St. Louis, Ill.
Charles Norton, Babcock & Wilcox Co., New York.

H. H. Wilder

H. E. Henderson

H. J. Jacobson

R. H. Stone, Vesuvius Crucible Co., Pittsburgh, Pa.
A. H. Thompson, Canadian Refractories, Ltd., Montreal. Que., Can.
R. A. Witschey, A. P. Green Fire Brick Co., Chicago.

Cost

PRESIDING: R. L. Lee, Grede Foundries, Inc., Milwaukee.
VICE-CHAIRMAN: George E. Tisdale, Zenith Foundry Co., Milwaukee.

Question and Answer Panel
PANEL MEMBERS:
A. C. Sinnett, Terre Haute Malleable & Mfg. Co., Inc. Terre Haute, Ind.
C. R. Culling, Carondelet Foundry Co., St. Louis.
C. E. McQuiston, Advance Foundry Co., Dayton, Ohio.
D. F. Palmer, U. S. Pipe & Foundry Co., Burlington, N. J.
N. J. Schmidt, Gunite Foundries Corp., Rockford, Ill.
J. A. Wagner, Wagner Malleable Iron Co., Decatur, Ill.
C. E. Westover, Westover Engineers, Milwaukee.

Gray Iron

PRESIDING: R. A. Clark, Electro Metallurgical Co., Detroit.
VICE-CHAIRMAN AND SECRETARY: C. K. Donoho, American Cast Iron Pipe Co., Birmingham, Ala.

(March issue)

Australian Methods of Producing Special Pipes
Official Exchange Paper, Institute of British Foundrymen, Victoria Branch.
G. J. Benson, Melbourne Technical College, Melbourne, Australia.

(Preprint 54-28)

The Importance of Cooling Rate on Physical Properties of Gray Cast Irons
Jules Henry, Forest City Foundries Co., Cleveland.

(Preprint 54-40)

The Risering of Semi-Circular Plate Castings
R. C. Shnay and S. L. Gertsman, Dept. of Mines & Technical Surveys, Ottawa, Ont., Can.

Sand

PRESIDING: C. F. Walton, Case Institute of Technology, Cleveland.
VICE-CHAIRMAN: W. D. Lawther, American Steel Foundries, East St. Louis, Ill.
SECRETARY: R. H. Greenlee, Auto Specialties Mfg. Co., St. Joseph, Mich.

Core Blowing Problems (Preprint 54-65)
J. A. Mescher, Unitcast Corp., Toledo, Ohio.

What is Stickiness in Core Sand Mixtures?
W. H. Buell, Aristo Corp., Detroit.

Olivine—Silica Molding Sands
G. S. Schaller and W. A. Snyder, University of Washington, Seattle.

4 pm

Sand

PRESIDING: J. H. Lansing, Malleable Founders' Society, Cleveland.
VICE-CHAIRMAN: C. F. Quest, J. F. Quest Foundry Co., Minneapolis.
SECRETARY: F. P. Goettman, Standard Sand Co., Grand Haven, Mich.

(April issue)

A Method of Establishing Standards for As-Cast Surfaces
Roy Loder, Erie Malleable Iron Co., Erie, Pa.

(Preprint 54-15)

Improving Surface Finish on Gray Iron Castings
W. G. Parker, General Electric Co., Elmira, N. Y.

(Preprint 54-56)

Statistical Analysis of Factors Affecting Casting Finish
D. C. Ekey and J. E. Goldress, Pennsylvania State University, State College, Pa.

Gray Iron

PRESIDING: H. W. Lownie, Jr., Battelle Memorial Institute, Columbus, Ohio.
VICE-CHAIRMAN AND SECRETARY: G. Vennerholm, Ford Motor Co., Dearborn, Mich.

Risering of Gray Iron Castings
AFS Gray Iron Research Progress Report No. 5
W. Schmidt, E. Sullivan, and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.

(April issue)

Calcium Carbide Injection—A New Metallurgical Tool for the Foundryman
J. M. Crockett, Air Reduction Sales Co., New York, and H. E. Henderson, Lynchburg Foundry Co., Lynchburg, Va.

Alloying and Heat Treating Spherulitic Graphite Cast Iron
C. C. Reynolds, and H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass.

5:30 pm

Registration Closes
Exhibits Close

6:30 pm

AFS Alumni Dinner
(For AFS Alumni only)
PRESIDING: I. R. Wagner, Electric Steel Castings Co., Indianapolis, Ind.

8 pm

Gray Iron Shop Course

PRESIDING: W. W. Levi, Lynchburg Foundry Co., Radford, Va.
VICE-CHAIRMAN: W. W. Holden, Eaton Mfg. Co., Vassar, Mich.

Cupola Bed Practice
DISCUSSION LEADER: D. E. Matthieu, Alabama Pipe Co., Anniston, Ala.

Sand Shop Course

PRESIDING: O. J. Myers, Archer-Daniels-Midland Co., Minneapolis.
VICE-CHAIRMAN: H. W. Schutzenhofer, Key Co., East St. Louis, Ill.

Fundamentals of Sand Control
MODERATOR: C. A. Sanders, American Colloid Co., Chicago.
PANEL MEMBERS:
C. H. Wyman, Burnside Steel Foundry Co., Chicago.
E. C. Troy, Foundry Engineer, Palmyra, N. J.

Friday, May 14

9 am

Registration Opens

Special Ford Plant Visit
Morning and afternoon inspection trips to Ford Motor Co., Berea, Ohio. Charter buses leave from Hotels Cleveland and Statler. Tickets at Plant Visitations desk.

9:30 am

Exhibits Open

V. Paschkis

W. W. Levi

W. K. Bock

R. A. Colton

V. E. Zang

John Perkins

C. F. Christopher

R. A. Loder

Floyd Brown

10 am

Gray Iron

PRESIDING: A. E. Schuh, U. S. Pipe & Foundry Co., Burlington, N. J.

VICE-CHAIRMAN AND SECRETARY: T. W. Curry, Lynchburg Foundry Co., Lynchburg, Va.

(Preprint 54-20)

Effect of Graphite Flake Size Upon the Tensile and Fatigue Properties of Gray Cast Iron

R. W. Lindsay, Pennsylvania State University, State College, Pa., and J. H. Hoke, Johns Hopkins University, Baltimore, Md.

The Relationship of the Carbon Equivalent to the Properties of Cast Iron

E. D. Bolden

H. W. Bielefeld

O. Z. Rylski

H. M. Skelly

M. V. Herasimchuck

P. W. Olson

V. K. Bhattacharya

W. C. H. Dunn

I. R. Kramer

W. C. Jeffery, E. E. Langner, Jr., W. G. Mitchell, and G. D. Azizi, University of Alabama, University, Ala.

(Preprint 54-1)

Graphitization of Certain Fe-C-Ti Alloys

A. B. Beach and R. W. Heine, University of Wisconsin, Madison.

Sand

PRESIDING: C. C. Sigerfoos, Michigan State College, East Lansing.

VICE-CHAIRMAN: D. C. Williams, Ohio State University, Columbus.

SECRETARY: D. S. Eppelsheimer, Missouri School of Mines, Rolla.

The Investigation of Steel Foundry Sands at Elevated Temperatures

13th Progress Report, AFS Sand Research Project

R. G. Thorpe, O. P. Eberlein, R. C. Waugh, and P. E. Kyle, Cornell University, Ithaca, N. Y.

(Preprint 54-2)

The Effect of Moisture Content on Silica Sand

E. D. Sayre, Aircraft Gas Turbine Div., General Electric Co., Cincinnati; and C. T. Marek, Purdue University, Lafayette, Ind.

(Preprint 54-69)

Metal Penetration Tests on Dry Sand Cores and Core Washes

Progress Report, AFS Mold Surface Committee 8-H.

C. C. Sigerfoos, Michigan State College, East Lansing.

Steel

PRESIDING: B. C. Yearley, National Malleable & Steel Castings Co., Cleveland.

VICE-CHAIRMAN AND SECRETARY: R. A. Willey, Commercial Steel Casting Co., Marion, Ohio.

Factors Which Determine Riser Adequacy Feeding Range

W. S. Pellini, Naval Research Laboratory, Washington, D. C.

A. G. Tompkins

T. A. Kraklow

C. W. Schmenn

Edward Trela

R. E. Morey

David Ekey

(This issue)

The Design and Operation of a Modern Heat Treating Department

R. W. Wilson, American Hoist & Derrick Co., St. Paul, Minn.

12 Noon

Registration Officially Closes

1 pm

Exhibits Officially Close

B. B. Bach

G. J. Benson

W. Y. Buchanan

1954 Convention Features International Authors

THREE papers by international authors, all in the gray iron field, will be presented at the 1954 AFS Convention. Two Official Exchange Papers are included, one from the Institute of British Foundrymen, the other from the same Institute's Victoria (Australia) Branch.

As indicators of current practice in the casting of gray iron overseas, these papers should have special significance for the many American and Canadian foundrymen attending the sessions.

B. B. Bach, research investigator, British Cast Iron Research Association, will present a paper entitled: *The Theoretical Aspects of Oxygen in Cast Iron* (Preprint 54-6), at the 10 am session of the Gray Iron Division on Thursday, May 13.

Mr. Bach was educated at King's Norton grammar school, Birmingham, received his technical education at the College of Technology, Birmingham, and received a B. Sc. at London University. He is a member of the Society of Chemical Industry and a Fellow of the Chemical Society. His first post was as analyst with Foundry Services, Ltd., following which he took his present position with British Cast Iron Research Association in 1945. He is in charge of research into the determination and effects of gases in cast iron.

G. J. Benson, Melbourne Technical College, Melbourne, Australia, has prepared the Official Exchange Paper for the Institute of British Foundrymen, Victoria Branch. It will be presented on Thursday, May 13, at 2 pm in a Gray Iron session, and is entitled *Australian Methods of Producing Special Pipes.* The paper was published in the March issue of AMERICAN FOUNDRYMAN.

Mr. Benson was apprenticed into the industry in 1908. After five years in the Royal Australian Navy during World War I, he returned to the industry. In 1922 he joined Messrs Graham Campbell Pty Ltd, became foreman in 1925. He held this position until 1938, when he joined the staff of Melbourne Technical College as instructor in metal founding, a position he has held since except for the recent war years. Mr. Benson is past president of the Australian Branch (Victoria) of the Institute of British Foundrymen, and is Convenor of the Institute's Apprenticeship Committee.

W. Y. Buchanan, foundry manager, John Lang & Sons, Ltd., Johnstone, Renfrewshire, Scotland, authored the Official Exchange Paper of the Institute of British Foundrymen: *The Melting of Cast Iron Borings and Steel Turnings in the Cupola.* It will be offered, with Mr. Bach's, at 10 am, Thursday, May 13 in a Gray Iron Session, and is published in this issue of AMERICAN FOUNDRYMAN.

Mr. Buchanan, a past president of the Institute's Scottish Branch, received his early training in the steel works of Wm. Beardmore & Co., and the Ardeer works of Nobels Explosive Co. After a number of years as metallurgist in Glasgow, he took a similar post in 1933 with John Lang & Sons, Johnstone, where he became foundry manager a year later, a position he still holds. He has presented many technical papers to the Institute since 1928, was awarded a Diploma in 1932, and the Oliver Stubbs Medal in 1944. He has served in the technical council and on various sub-committees since 1933. He has also held the position of lecturer in foundry practice to the Glasgow and West of Scotland Royal Technical College for the past 16 years.

Other papers by foreign authors are *Some Experiences in the Shell Molding of Copper-Base Alloys,* by S. S. Brown and H. K. Worner, Shellmould Div., W. O. and B. Adams Pty., Ltd., Melbourne, Australia; and *Zircon Sands—Occurence and Uses in Australian Industry* (Official Exchange Paper, Institute of Australian Foundrymen, New South Wales Div.), by Paul Markwell, McLean Castings, Ltd., Sydney, Australia.

Shop Courses Listed

FOR the added convenience of foundrymen attending the Convention, Shop Courses are listed here:

Shop Courses

Gray Iron: *Monday, May 10*—Coke Screening and its Relation to Cupola Operation
Tuesday, May 11—Gating to Control Pouring Rate and its Effect on Casting Quality
Thursday, May 13—Cupola Bed Practice

Brass & Bronze: *Monday, May 10*—Core Boxes, Ovens and Driers
Tuesday, May 11—Developments in Core Making

Sand: *Monday, May 10; Tuesday, May 11; Thursday, May 13*—Fundamentals of Sand Control (all three sessions)

Malleable Iron: *Monday, May 10*—Melting Malleable Iron. *Tuesday, May 11*—Malleable Annealing Practice

Refractories: *Thursday, May 13*—Importance of Refractories

OFFICERS and DIRECTORS of the AMERICAN FOUNDRYMEN'S SOCIETY

President
Collins L. Carter, Albion Malleable Iron Co., Albion, Mich.

Vice-President
Frank J. Dost, Sterling Foundry Co., Wellington, Ohio

J. L. Wagner (Term expires 1954), Electric Steel Castings Co., Indianapolis

A. L. Hunt (Term expires 1954), National Bearing Div., American Brake Shoe Co., St. Louis

H. W. Dietert (Term expires 1954), Harry W. Dietert Co., Detroit

J. T. MacKenzie (Term expires 1954), American Cast Iron Pipe Co., Birmingham, Ala.

A. M. Ondreyco (Term expires 1954), General Metals Corp., Oakland, Calif.

W. J. Klayer (Term expires 1955), Aluminum Industries, Inc., Cincinnati

E. C. Hoenicke (Term expires 1956), Eaton Manufacturing Co., Detroit

J. O. Klein (Term expires 1955), Texas Foundries, Inc., Lufkin, Texas

M. A. Fladoes (Term expires 1955), Sivyer Steel Casting Co., Milwaukee

M. J. Lefler (Term expires 1956), The Oliver Corp., South Bend, Ind.

M. J. O'Brien, Jr. (Term expires 1954), Atlas Foundry & Machine Co., Tacoma, Wash.

A. D. Matheson (Expires 1955), French & Hecht Div., Kelsey Hayes Wheel Co., Davenport, Iowa

G. Ewing Tait (Term expires 1956), Dominion Engineering Works, Ltd., Montreal, Que., Canada

H. G. Robertson (Term expires 1955), American Steel Foundries, Alliance, Ohio

Thomas Kaveny, Jr. (Term expires 1956), Herman Pneumatic Machine Co., Pittsburgh, Pa.

C. V. Nass (Term expires 1956), Beardsley & Piper Div., Pettibone Mulliken Corp., Chicago

Ladies' Entertainment Committee

Mrs. Walter L. Seelbach
Mrs. Frank J. Dost
Mrs. Howard E. Heyl
Mrs. F. Ray Fleig
Mrs. Alexander D. Barczak
Mrs. George Clifford
Mrs. Lewis T. Crosby
Mrs. George E. Miller
Mrs. Walter Quayle
Mrs. Harold Strater
Mrs. J. F. Roth
Mrs. Edwin Bremer
Mrs. W. H. Redhead
Mrs. Ed Kreager
Mrs. E. Claude Jeter
Mrs. A. J. Harlan
Mrs. R. D. Walter
Mrs. A. J. Dubie
Mrs. Gordon Wiltse
Mrs. A. R. Troiano
Mrs. Frank C. Cech

Chairman—**Mrs. Stephen E. Kelly**

FOR the LADIES

Vice-Chairman—**Mrs. David Clark, Jr.**

Ladies' program includes varied fare—from afternoon teas to Broadway revues at the Alpine Village, which will feature the Dewey sisters (below).

THE Ladies' Entertainment Committee of the Northeastern Ohio Host Chapter is headed by Mrs. Stephen E. Kelly, *Chairman*, and Mrs. David Clark, Jr., *Vice-Chairman*. They and their committee members have arranged a program crammed with varied entertainment for foundrymen's ladies during Convention week. In addition, ample time is provided for shopping in Cleveland's many fashionable stores, and sightseeing in one of the nation's most important cities. Here are the highlights of scheduled events:

Monday, May 10, 3-4:30 pm: Official AFS Tea, Red Room, Hotel Cleveland. Music by trio headed by Jack Pollack, of the theater, motion pictures, and radio.

Tuesday, May 11, 12 noon: Luncheon, Alpine Village, 1614 Euclid Ave. A delightful luncheon, door prizes, and complete Broadway revue by stage and TV stars. The Alpine Village is one of the nation's oldest theater restaurants, featuring food to charm a gourmet in full continental atmosphere.

Wednesday, May 12, 7 pm: Annual AFS Banquet, Arena, Public Auditorium. Presentation of Society awards, followed by a sparkling program of entertainment.

Thursday, May 13, 12 noon: Luncheon, Westwood Country Club, transportation provided. Luncheon will be followed by a demonstration of flower arranging and designing by Irene Jones, known for her work at Knoble's School of Floral Design, and television features. Miss Jones will show you how to achieve the most exquisite touches in floral decoration while retaining the flavor of your own personality.

S. E. Kelly

David Clark, Jr.

W. L. Seelbach

HOSTS of the AFS Convention

AFS Northeastern Ohio Chapter

President—Stephen E. Kelly, Eberhard Mfg. Co., Div. of Eastern Malleable Iron Co.

1st Vice-President & Program Chairman—David Clark, Jr., Forest City Foundries Co.

2nd Vice-President—Lewis T. Crosby, Sterling Wheelbarrow Co.

Secretary—Howard E. Heyl, Federal Foundry Supply Co.

Treasurer—F. Ray Fleig, Smith Facing & Supply Co.

Chapter Directors

Alexander D. Barczak, Superior Foundry, Inc.
George Clifford, Fulton Foundry & Machine Co.
Frank Cech, Cleveland Trade School
George E. Miller, Osborn Mfg. Co., Machine Div.
Walter Quayle, National Malleable & Steel Castings Co.
Harold R. Strater, Cleveland Warehouse Div., North American Refractories Co.
Edwin Bremer, Penton Publishing Co.
E. Claude Jeter, Ford Motor Co.
Edward Kreager, Henry Furnace Co.
W. H. Redhead, Lake City Malleable Co.
John F. Roth, Cleveland Standard Pattern Works Co.
A. J. Harlan, Hickman-Williams & Co.
R. D. Walter, Archer-Daniels-Midland Co.
Dr. Alex Troiano, Case Institute of Technology
A. J. Dublo, Sterling Foundry Co.
Gordon A. Wiltse, Parker-Street Castings Co.

General Convention Committee

Honorary Chairman—AFS Past National President W. L. Seelbach, Superior Foundry, Inc.

Chairman—Stephen E. Kelly, Eberhard Mfg. Co.

Vice-Chairman—David Clark, Jr., Forest City Foundries Co.

Secretary—Howard E. Heyl, Federal Foundry Supply Co.

Treasurer—F. Ray Fleig, Smith Facing & Supply Co.

Harold R. Strater, North American Refractories Co.
Walter E. Sicha, Aluminum Co. of America
Henry J. Trenkamp, Jr., Ohio Foundry Co.

Reception Committee

Chairman—Howard C. Gollmar, Elyria Fdy. Div., Industrial Brownhoist Co.

Vice-Chairman—Walter E. Sicha, Aluminum Co. of America

Bruce Aiken, Crucible Steel Casting Co.
F. E. Bair, Ohio Brass Co.
Foster Baker, Sandusky Foundry & Machine Co.
H. A. Baker, Oiless Core Binder Co.
Charles A. Barnett, Foundry Equipment Co.
Seymour N. Barr, Master Pneumatic Tool Co., Inc.
Bruce A. Barrett, Chandler & Price Co.
O. M. Beach, Frank L. Crobaugh Co.
Robert K. Beck, Apex Smelting Co.
John T. Bradley, Fanner Mfg. Co.
Homer Britton, Cleveland Foundry Co.
Joseph H. Bruce, Bowler Foundry Co.
John H. Buchanan, Industrial Silica Corp.
Thornton S. Carman, Edwin S. Carman, Inc.
J. E. Carroll, G. & C. Foundry Co.

continued next page

Reception Committee (Contd.)

J. E. Carson, Brost Pattern & Casting Co.
H. F. Corrigan, Hill-Acme Co.
James M. Crane, Jr., Klotz Machine Co.
Lester D. Criswell, Wellman Products Co.
B. T. Day, Jr., American Fire Clay & Products Co.
Andrew C. Denison, Fulton Foundry & Machine Co.
Frank J. Dost, Sterling Foundry Co.
Thomas Dougherty, Dougherty Lumber Co.
B. W. Duncan, Alloy Precision Castings Co.
E. G. Fahlman, Permold Co.
J. G. G. Frost, Aluminum & Magnesium, Inc.
William A. Gluntz, Gluntz Brass & Aluminum Foundry Co., Inc.
Richard A. Green, Eastern Clay Products Co.
Howard M. Greenbaum, Acme Foundry Corp.
J. Wm. Grodin, River Smelting & Refining Co.
Joseph Hanks, Jr., Taylor & Boggis Foundry Co.
Tom Harvey, Grabler Mfg. Co.
J. B. Heisler, A. C. Williams Co.
Herbert S. Hersey, C. O. Bartlett & Snow Co.
L. H. Heyl, Federal Foundry Supply Co.
C. E. Hilkert, Republic Steel Corp.
R. S. Hoffman, Hoffman Foundry Supply Co.
E. Claude Jeter, Ford Motor Co., Cleveland Foundry
William M. Jones, Cleveland Quarries Co.
J. H. Keating, Monarch Aluminum Mfg. Co.
Ernest T. Kindt, Kindt-Collins Co.
Frank W. Klatt, W. W. Sly Mfg. Co.
Leo M. Kraus, Diamond Foundry Co.
Ed Kreager, Henry Furnace Co.
James H. Lansing, Malleable Founder's Society
Walter O. Larson, W. O. Larson Foundry Co.
Henry C. LeBeau, Ohio Injector Co.
Jack Levand, Luria Bros. & Co., Inc.
Melvin G. Leypoldt, Manufacturers Supply Co.
J. B. Louy, Fire Brick Service & Supply Co.
William C. Manwell, M. B. M. Foundry, Inc.
Leon F. Miller, Osborn Mfg. Co.
B. G. Parker, Youngstown Foundry & Machine Co.
Joseph J. Parker, SPO, Inc.
John S. Parker, Motor Patterns Co.
B. R. Pearse, Atlas Foundry Co.
E. G. Pekarek, Thompson Products, Inc.
George M. Peters, Madison Foundry Co.
Fred J. Pfarr, Lake City Malleable Co.
Steve Plautz, W. S. Tyler Co.
John M. Price, Ferro Machine & Foundry, Inc.
Karl T. Rinderle, Brown Industries, Inc.
Leroy P. Robinson, Archer-Daniels-Midland Co.
Lowell D. Ryan, Malleable Founders' Society
P. H. Ryder, Ryder Brass Foundry Co.
Anthony E. Schauer, Schauer Bronze & Aluminum Foundry
Charles F. Seelbach, Forest City Foundries Co.
J. B. Shaver, Iron Lung Ventilator Co.
Frank G. Steinebach, Penton Publishing Co.
O. S. Stewart, Cleveland Metal Abrasive Co.
George W. Striebing, Pickands, Mather & Co.
R. G. Sweeney, Allyne-Ryan Foundry Co.
Michael G. Thomas, Cleveland Punch & Shear Works Co.
John H. Tressler, Hickman-Williams & Co.
Arthur J. Tuscany, Foundry Equipment Manufacturers' Association
D. V. Walker, Eberhard Mfg. Co.
Fred S. Wellman, Wellman Bronze & Aluminum Co.
Ralph R. West, West Steel Casting Co.
C. S. Winter, Duplex Mfg. & Foundry Co.
Fred J. Woodburn, American Steel & Wire Co.

Banquet Committee

Chairman—Alexander D. Barczak, Superior Foundry, Inc.
Vice-Chairman—Gilbert J. Nock, Nock Fire Brick Co.
E. R. Crosby, Smith Facing & Supply Co.
H. Charles Esgar, Foundry Educational Foundation
Earle Smith, Republic Steel Corp.
Joseph J. Parker, SPO, Inc.
E. C. Zirzow, Werner G. Smith, Inc.
Arthur J. Harlan, Hickman-Williams & Co.

continued on page 98

W. L. Woody

A. D. Barczak

L. T. Crosby

H. W. Wheeler

Publicity Committee

Chairman—Harold Wheeler, Superior Foundry, Inc.
Vice-Chairman—Robert H. Herrmann, Penton Publishing Co.
Edwin Bremer, Penton Publishing Co.
William G. Gude, Penton Publishing Co.
Sterling N. Farmer, Sand Products Corp.
R. M. Fisher, American Steel and Wire Co.
Thos. W. Gallagher, Foundry Legislative Committee of Ohio
Robert C. Boehm, Wellman Bronze & Aluminum Co.
Gordon A. Wiltse, Parker-Street Castings Co.
William Gorman, Ohio Injector Co.
Earl Martinson, Lodi Foundry Co.

Plant Visitation Committee

Chairman—Walton L. Woody, National Malleable & Steel Castings Co.
Vice-Chairman—E. M. Knapp, Ferro Machine & Foundry Co., Inc.
Vice-Chairman—A. C. Denison, Fulton Foundry & Machine Co.

Shop Course Committee

Chairman—Frank C. Cech, Cleveland Trade School
Vice-Chairman—James G. Goldie, Cleveland Trade School
J. C. Beattie, Fulton Foundry & Machine Co.
Chas. W. Briggs, Steel Founders' Society of America
Carl Fisher, Superior Foundry, Inc.
George J. Gedeon, Aluminum Co. of America
Walter A. Krey, Forest City Foundries Co., Inc.

F. C. Cech

J. M. Davenport

H. C. Gollmar

Northeastern Ohio Day Committee

Chairman—John Davenport, Fulton Foundry & Machine Co.
Vice-Chairman—Richard A. Green, Eastern Clay Products Co.
John M. Urban, Diamond Alkali Co.
H. Oliver Pels, Eberhard Mfg. Co.
Peter Rettig, Rettig Pattern Co.
Milton Tilley, National Malleable & Steel Castings Co.
John H. Sibbison, Jr., American Fire Clay & Prod. Co.
Jack J. Kroecker, Mohawk Foundry Inc.
Arthur M. Clark, Ford Motor Co., Cleveland Foundry
Maurice F. Degley, Ferro Machine & Foundry Co., Inc.
Frank L. Barton, Fulton Foundry & Machine Co.
William Foley, Henry Furnace Co.
Michael A. Horlak, Case Institute of Technology
Warner B. Bishop, Archer-Daniels-Midland Co.
John M. Fox, Aluminum Co. of America
Edward Hrdlicka, Superior Foundry, Inc.
Executive Secretary—Emil J. Romans, National Malleable & Steel Castings Co.
Technical Advisor—Lewis T. Crosby, Sterling Wheelbarrow Co.
Frank L. Barton, Fulton Foundry & Machine Co.
Warner B. Bishop, Archer-Daniels-Midland Co.
William S. Duncan, Pickands, Mather & Co.
Richard A. Green, Eastern Clay Products Div., International Minerals & Chemical Corp.
Milton L. Huemme, Diamond Alkali Co.
Louis Klein, Crucible Steel Castings Co.
Clifford H. Lambert, Eberhard Mfg. Co.
Lloyd W. Leeseburg, Superior Foundry Inc.
Walter T. Mikulitz, Ferro Machine & Foundry Co.
John S. Parker, SPO, Inc.
Charles F. Seelbach, Jr., Forest City Foundries Co.
Henry J. Trenkamp, Jr., Ohio Foundry Co.
Paul B. Temple, Ford Motor Co.
Thomas D. West, West Steel Casting Co.
Lowell D. Ryan, Malleable Founders' Society
Leslie Schuman, National Malleable & Steel Castings Co.
Chas. F. Walton, Case Institute of Technology

1954 AFS Exhibits Committee

Chairman—Collins L. Carter, AFS President, Albion Malleable Iron Co.
L. L. Andrus, American Wheelabrator & Equipment Co.
F. B. Flynn, S. Obermayer Co.
J. A. Gitzen, Delta Oil Products Co.
L. H. Heyl, Federal Foundry Supply Co.
Thos. Kaveny, Jr., Herman Pneumatic Machine Co.
E. F. Kindt, Kindt-Collins Co.
R. L. McIlvaine, National Engineering Co.
C. V. Nass, Beardsley & Piper Div., Pettibone Mulliken Corp.
H. J. Niemann, Hydro-Blast Corp.
F. A. Pampel, Chain Belt Co.
C. A. Sanders, American Colloid Co.
V. F. Stine, Pangborn Corp.
W. W. Maloney, AFS Secretary-Treasurer
A. A. Hilbron, AFS Convention and Exhibits Manager

Ford Motor Company's Cleveland Foundry moved the seashore indoors for its casting sand. Shown is section of storage building which has storage capacity of over 54,000 tons of sand. Ford foundry is on plant visitations schedule on Friday, May 14.

Plant Visitations Program

FOUNDRYMEN attending the 1954 AFS Convention and Exhibit at Cleveland will be provided the opportunity to visit some of the finest metals casting plants in the nation. The Plants Visitation Committee has arranged a program that will include all types of foundries—gray iron, aluminum, steel, brass and bronze, malleable iron, nickel chrome alloys, pattern shops, and all degrees of mechanization.

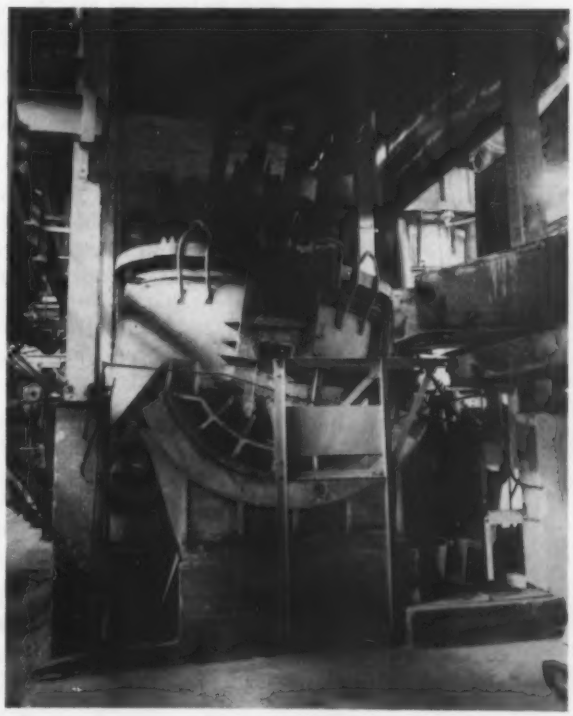
Chairman Walton L. Woody, National Malleable & Steel Castings Co., has been in charge of this activity, assisted by E. M. Knapp, Ferro Machine & Foundry Co., Inc., and A. C. Denison, Fulton Foundry & Machine Co., vice-chairmen. Emil J. Romans, National Malleable & Steel Castings Co. is executive secretary of the Committee, and Lewis T. Crosby, Sterling Wheelbarrow Co., the technical advisor.

Foundrymen wishing to visit the plants listed below are urged to register at the Plant Visitations desk in the AFS Headquarters booth in the Auditorium hall, where Committee members will be available at all times. Maps, pamphlets, and other information to aid visitors in reaching the various plants will be provided.

Ford Cleveland Foundry

One of the features of the program is the visitation to the Ford Motor Company's Cleveland Foundry, one of the most modern and highly mechanized gray iron plants in the world. The plant will receive visitors between 9 am and 12 noon, and from 1 to 4 pm on Friday, May 14 only. Address for those traveling privately is 5600 Engle Road, Brook Park, Ohio; telephone Winton 1-6200. Omer LaVerne, plant personnel representative, will be the contact at the foundry. The Committee has arranged group transportation for foundrymen without other means. Chartered buses will leave from the downtown area both morning and afternoon, and will return at the conclusion of the visits. A small fee will be charged. Those wishing to travel by bus should make reservations no later than Thursday, May 13, at the Headquarters booth.

Complete information on other plants participating in the visitations program is listed below:



This tilting-type electric arc furnace is typical of the type of foundry operations to be seen during the plant visit to the Cleveland Works of National Malleable and Castings Co. on Tuesday, May 11.

Fabulous Ford Cleveland Foundry is industrial masterpiece.

Allyne-Ryan Foundry Co. Aetna Road and E. 91st St., Cleveland. (Tel: VU 3-7700) Wed., May 12, 9 am to 12 noon. Contact in charge—R. G. Sweeney, president, and F. L. Feltes, vice-president and general manager. Gray iron, semi-mechanized shop, cylinders, automotive castings, diesel engines.

Arrow Aluminum Castings Corp. 3135 Berea Road, Cleveland. (Tel: AC 1-7255) Mon., May 10, 1 pm to 4:30 pm. Contact in charge—Peter J. Petto, Jr, vice-president. Sand and permanent mold aluminum castings, semi-mechanized shop.

Crucible Steel Castings Co. 8401 Almira Ave., Cleveland. (Tel: OL 1-1155) Thurs., May 13, 9 am to 12 noon. Contact in charge—Walter Poremba, assistant superintendent. Steel castings, semi-mechanized shop, pneumatic sand reclamation system.

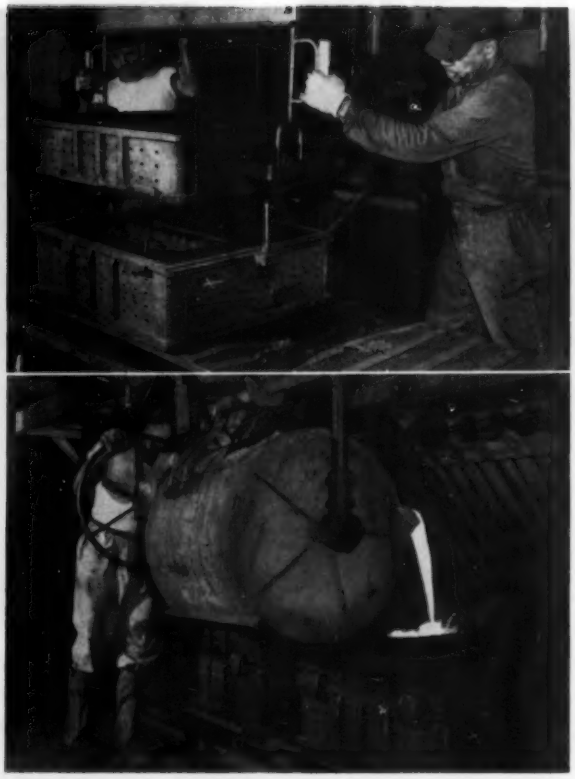
Forest City Foundries Co. (Plant B) West 94th and Maywood Ave., Cleveland. (Tel: OL 1-3200) Wed., May 12, 10 am to 12 noon. Contact in charge—William Cowell, personnel manager. Gray iron, semi-mechanized shop, castings from 5 - 150 lb.

Fulton Foundry & Machine Co., Inc. East 75th and Morgan Ave., Cleveland. (Tel: MI 1-8400) Tues., May 11, 9 am to 12 noon. Contact in charge—A. C. Denison, president; F. L. Barton, vice-president; G. T. Clifford, superintendent. Gray iron, semi-mechanized jobbing foundry and jobbing machine shop. (Visitors accepted on other days, mornings only.)

Gluntz Brass & Aluminum Foundry Co. 10805 Harvard Ave., Cleveland. (Tel: MI 1-3575) Mon. and Tues., May 10 and 11, 12 noon to 3 pm. Contact in charge—D. J. Gluntz, president; W. A. Gluntz, secretary-treasurer; E. P. Gallagher, superintendent. Brass, bronze and aluminum castings, pattern shop.

Master Pattern Co. 1315 Main Ave., Cleveland. (Tel: MA 1-2035) Thurs., May 13, 9 am to 12 noon. Contact in charge—M. Pierie, superintendent. Modern pattern shop and permanent mold specialty.

Meech Foundry Co. 9914 Meech Ave., Cleveland. (Tel: MI 1-5550) Tues., May 11, 9 am to 12 noon. Contact in charge—L. Luks, president. Gray iron, mechanized, sand conditioning and molding unit.



Motor Pattern Co. 3035 E. 61st St., Cleveland. (Tel: MI 1-2500) Wed., May 12, 9 am to 12 noon. Contact in charge—Frank Oklessen, vice-president; and Edward Pierie, plant manager. Completely equipped pattern shop, 100 patternmakers.

National Malleable & Steel Castings Co. (Foundry) 10600 Quincy Ave., S. E., Cleveland. (Tel: GA 1-3400) Tues., May 11, 9 am to 11:30 am. Contact in charge—Stewart Tame, manager. Mechanized malleable iron foundry, electric heat treating of pearlitic malleable.

National Malleable & Steel Castings Co. (Technical Center) 2570 Woodhill Road, Cleveland. (Tel. GA 1-3400) Tues., May 11, 1 pm to 4:30 pm. Contact in charge—K. L. Selby, chief engineer, Technical Center. Centralized technical organization for entire company, new and modern physical testing laboratory.

Standard Alloy Co., Inc. 1679 Collamer Rd., Cleveland. (Tel: GL 1-6077) Mon., May 10, 1 pm to 3:30 pm. Contact in charge—L. W. Anderson, plant superintendent. High nickel chrome alloy, heating and corrosion applications; specialty custom shop.

Superior Foundry, Inc. 3542 E. 71st St., Cleveland. (Tel: VU 3-8000) Tues., May 11, 9 am to 12 noon. Contact in charge—Alexander D. Barczak, plant manager. Gray iron, mechanized and semi-mechanized operation.

West Steel Castings Co. 805 E. 70th St., Cleveland. (Tel: EN 1-4540) Thurs., May 13, 9 am to 12 noon. Contact in charge—Thomas D. West, vice-president and manager; Sam West, chief engineer; Gordon Williams, assistant manager. Steel castings, laboratory, pattern shop, molding shop.

1954 Convention Preprints

Each year prior to the Annual AFS Convention, AMERICAN FOUNDRYMAN publishes some of the papers scheduled for presentation as examples of the material planned by the divisions and committees of the Society. This puts some papers received too late for preprinting separately into the hands of foundrymen prior to the Convention. This year, "The Foundrymen's Own Magazine" printed the papers listed on this page. In addition, several other Convention papers will be published in forthcoming issues. Separate preprints will not be available at the Convention.

In this Issue

A Modern Heat Treating Department, *R. W. Wilson* 102

Producing Titanium Alloy Castings, *Marvin Glasenberg and M. J. Berger* 107

Gating and Risering of Magnesium Alloys—Part 2, *H. E. Elliott* 113

Pre-Mixing of Sand Reconditioning Materials, *Burdette Jones* 123

Cupola Melting of Iron Borings and Steel Turnings, *W. Y. Buchanan* 127

Recent Shell Molding Developments, *E. I. Valyi* 138

April issue

Calcium Carbide Injection, *J. M. Crockett and H. E. Henderson* 42

Establishing Standards for As-Cast Surfaces, *R. A. Loder* 44

Heat Transfer Characteristics in Shell Molds, *R. E. Morey, H. F. Bishop, and W. S. Pellini* 46

Pouring Temperature Effect on Steel Castings, *C. F. Christopher* 51

Gating and Risering of Magnesium Alloys—Part 1, *H. E. Elliott* 56

Fluidity vs. Core Blows in Automotive Gray Iron, *A. A. Evans* 66

Economical Gating of Yellow Brass Castings, *C. L. Mack* 70

March issue

Casting Quality and Sand pH Value, *V. E. Zang and G. J. Grott* 49

Special Pipe Production in Australia, *G. J. Benson* 63

White Iron Strength in Hot Tearing Range, *J. P. Frenck and R. W. Heine* 68

February issue

Prebaking in Malleablizing Iron, *Floyd Brown* 50

Designing and Operating A Heat Treating Department

RICHARD W. WILSON / *Asst. Fdry. Supt. and Chief Met., American Hoist & Derrick Co., St. Paul, Minn.*

Furnaces, quenching systems, and material handling equipment must be selected on basis of heat treating operations required and possible future expansion. Written discussion of this paper, Convention Preprint No. 54-41, should be sent to American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, Ill. The paper will be presented at a Steel Session of the AFS 58th Annual Meeting, Cleveland, May 8-14, 1954.

■ This paper deals with the application of metallurgical principles, properly seasoned with the art of steel treating, to arrive at a suitably designed modern heat treating department. It must be borne in mind that the practices and shop layout established here were developed for a particular set of conditions; however, similar reasoning may be followed in designing any heat treating installation.

The heat treating installation described was designed primarily to handle the annealing of low alloy cast gears, hardening and tempering of carbon and low alloy steel castings, and the stress relieving of certain gray iron castings. It was also required that the department be equipped to harden and temper alloy steel shafts and for carburizing special castings, axles and bushings.

Thorough Detailing Needed

The first step in arriving at a plant design is the making of detailed descriptions of all the required processes. The descriptions must include material specifications of work to be treated, physical properties desired, special quality requirements, and the general shape and size of the work. The need for strict attention to details at this stage cannot be over-emphasized because it is here that the type of furnaces, quenching systems, and even the type of handling equipment is actually decided.

A survey must be made of production quantities to be treated by the various processes which entails delving into past production records and consultation with the engineering and sales departments. This phase of the investigation determines the size and number of furnaces and auxiliary equipment.

Inasmuch as the conditions will vary a great deal from plant to plant the details of determining production demands will not be discussed further. The processes involved will, however, be discussed in detail to show how they form the framework for the design of a modern heat treating department.

Annealing of Low Alloy Steel Castings. For the most part, all gears, pinions and sprockets that require through hardening are cast from a steel conforming in chemical composition to AISI 8740. This triple alloy cast steel has notoriously poor machinability unless annealed to produce improved machining characteristics.

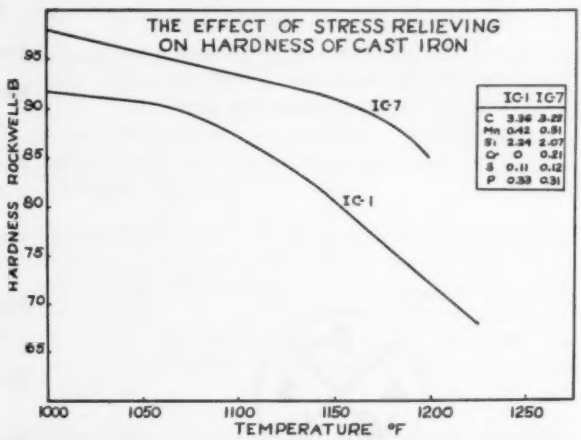


Fig. 1—Effect of stress relieving temperature on hardness of cast iron produced by author's company.

Cycle-Annealing Furnace

An electrically-heated, atmosphere-controlled pit type furnace having a working diameter of 36 in. and a depth of 60 in. was selected for cycle annealing.[1] This process requires that the castings, after having been austenitized at 1600 F, be transferred to a cooling pit while the load and furnace cools to 1200 F. The load is then returned to the furnace for the transforma-

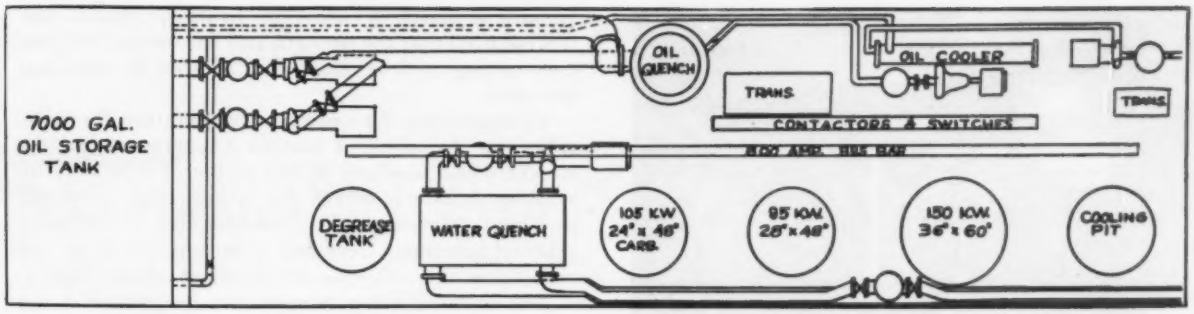


Fig. 2—Equipment layout in a modern heat treating department.

tion. Several batches of annealed work were treated according to the cycle anneal requiring a transfer to the cooling pit for cooling to the transformation temperature, and several batches were merely allowed to cool in the furnace after the power was turned off. The cycle annealing process produced slightly harder product with a fine pearlitic structure. The slow cool produced spheroidized structure having a hardness 30 points lower in Brinell than the cycle anneal.

The equipment was selected so that the present production level would only require a single shift operation thereby allowing room for increasing the production capacity quickly when required by merely putting on a second shift. The present single shift operation allows ample time for a full anneal without rapidly cooling to the transformation temperature.

No Time-Saving Advantage

At the present production level there is no particular advantage in using the time saving process. Slow cooling in the furnace will be continued until greater production capacity is required at which time it will be discontinued in favor of rapid cooling to a suitable transformation temperature. It should be emphasized, however, that there is no metallurgical reason for slow cooling from the austenitizing to the transformation temperature.

The furnace and cooling pit are both equipped to maintain a controlled atmosphere so the annealed castings are ready for the machine shop without further cleaning.

Hardening and Tempering Low Alloy Steel Castings. The alloy steel castings that have been annealed prior to machining must be hardened and tempered after machining.

It is planned that the furnace used for the annealing process will be available two days per week for hardening and tempering. In addition to this, an atmosphere controlled pit furnace having a diameter of 28 in. and depth of 48 in. is required to furnish the additional furnace capacity. It should be realized that a furnace load that is to be quenched must be arranged to allow for the desired uniform heat transfer during the quenching operation and therefore the furnaces cannot always be loaded to capacity.

The machined castings to be hardened are loaded on a spindle or suitably designed fixture and the entire load placed in the hot furnace. Since the temperature is above 1400 F when loaded, the furnace is immediately purged with protective atmosphere and as soon as the purging is complete as indicated by the exhaust flame, the flow of gas is reduced. When the load has been soaked at temperature for the required time, the loaded fixture is withdrawn and plunged into the quench. It is essential that the quenching system be designed for the size of load and the frequency that the batches are to be quenched in order to produce uniformly hardened parts with minimum distortion.

Excess Smoke Formed

The original plan was to merely allow the quenching oil to drain from the parts and to spill trapped oil from surfaces that will not drain freely before placing the loaded fixture back in the furnace for tempering. It was found, however, that the adhering oil formed an excessive amount of smoke during tempering so an alkaline degreasing unit was designed which removes the oil film from the work prior to tempering.

When the tempering treatment is complete the castings are cooled by the fastest practical method as it is not necessary to cool slowly from the tempering temperature.

Hardening and Tempering Carbon Steel Castings. Castings in this category are rollers and wheels requiring sufficient hardness to resist rolling wear. In this particular case the equipment had to be designed to preferentially quench the rolling surface on the wheels leaving the hub relatively soft. The rollers, however, need only be totally quenched and tempered to a uniform specified hardness.

The two furnaces mentioned previously for annealing and hardening alloy steel castings have sufficient capacity to be used for the wheels and rollers. Efficient utilization of furnace equipment is made possible by the character of the company's production which is

Fig. 3—Cooling pit and furnaces have open top 16 in. above floor for convenience in handling castings.

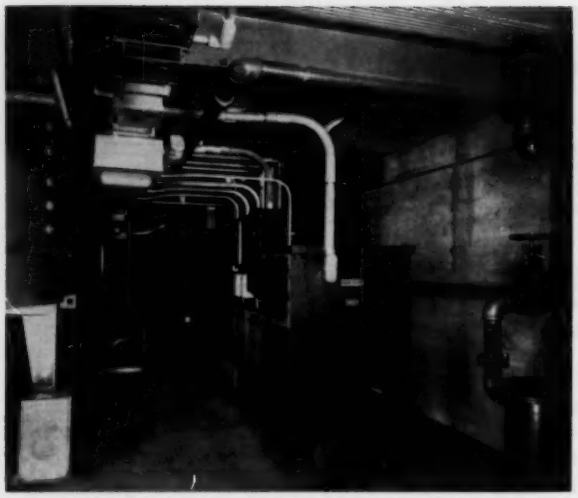


Fig. 4—Basement of heat treating department provides pit for furnaces, contains auxiliary equipment and quench-medium pumps.

such that the peak demand for rollers does not occur at the same time as the peak demand for heat treated gears.

The parts that must be preferentially quenched are similar to double-flanged railroad wheels. Each wheel must have an individual fixture to facilitate its removal from the furnace. These are designed so that they nest together when stacked in the furnace. When the load has been soaked at temperature for sufficient time the top wheel is removed and placed in a quenching ring which sprays water on the rolling surface. The spraying continues until only the hub remains at a red heat and the procedure is repeated until the entire load has been quenched. It is essential that the tempering operation be performed immediately because of the high thermal stresses developed by a preferential quench.

Rollers that are totally quenched are stacked on vertical bar type fixtures. In the case of small rollers, two or three fixtures can be loaded in a single furnace and quenched in a water system having suitable circulation to produce uniform hardness with minimum distortion.

Since carbon steel castings are susceptible to temper brittleness it is desirable to keep the tempering time to a minimum followed by rapid cooling from the draw temperature.

Stress Relief of Gray Iron. The elimination of localized stress in cast iron is achieved by reducing the elastic properties of the casting permitting a minute amount of plastic deformation. In this particular case it is essential that the strength and hardness of the gray iron castings not be materially affected by this heat treatment.

To determine the optimum temperature for stress relieving, the affect of various temperatures on the structure and hardness of two grades of iron were investigated. Some results of this investigation are shown in Fig. 1. Metallographic examinations of the stress relieved specimens revealed a decomposition of the carbide as the temperature increased above 1050 F.

The stress relieving temperature for gray iron was standardized at 1025 F and the 36 x 60-in. furnace utilized for the treatment. Since this additional production burden may prove to be excessive a recirculating air furnace is included in plans for expansion of facilities.

Case Hardening. A vertical-retort, pit-type furnace having a diameter of 24 in. and a 48-in. working depth was chosen to provide ample case hardening capacity. The work load is placed in a furnace controlled at 1700 F and the retort is purged with a neutral gas. As soon as the system is purged the flow is reduced and the required flow of natural gas is fed into the natural gas system.

The carbon content of the case may be controlled by following the carburizing period with a time in the furnace after the natural gas has been turned off which allows the carbon on the surface to diffuse toward the core. The diffusion period is followed by a cooling period when the temperature of the load is lowered to 1500 F preparatory to quenching.

Department Layout

Furnace Equipment. The three furnaces, cooling pit, and water quench tank are all installed along a common center line. Steel grating forms the flooring around these units as shown in Fig. 3. Reinforced concrete slabs cover the remaining areas above the basement so that a lift truck can be used to deliver the work in tote boxes under the crane used to service the furnaces.

The cooling pit, oil quench tank, and furnaces are installed so that the level of the open top is 16 in. from the floor, a height which has proven to be practical.

Electric power is delivered via an 800-amp bus bar running the length of the basement servicing the furnace transformers, and pump motors. All electrical connections from bus bar to transformers and from transformers to furnaces are reasonably short with this arrangement.

The location of the furnaces relative to the quench-

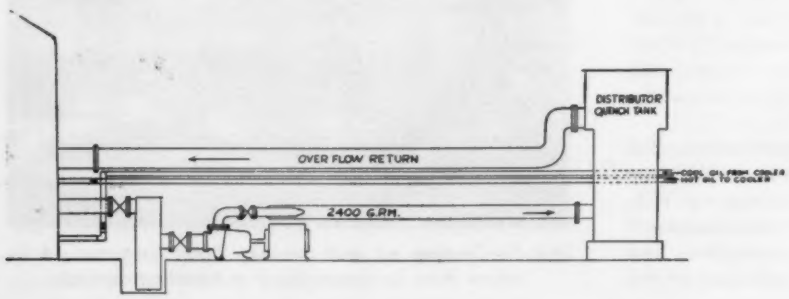


Fig. 5—Side view of oil quenching system does not show second oil pump. See Fig. 2 for plan view.

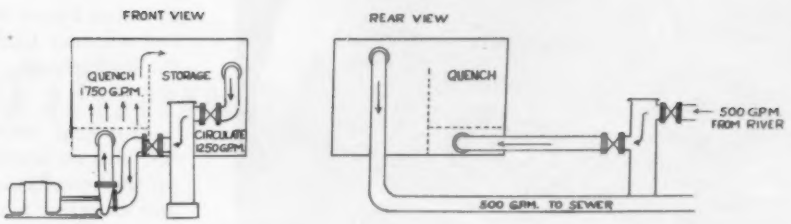


Fig. 6—Water quenching system combines storage and quench tank. River is source of quenching water.

ing facilities and to each other is shown in the layout drawing in Fig. 2 whereas Fig. 3 and 4 are views of the department both above and below the floor.

Atmosphere Generator. An electrically- heated, endothermic generator having a capacity of 750 cu ft of gas per hour was selected to furnish protective atmosphere to the furnaces. Actually this generator is a furnace containing a catalyst through which a controlled mixture of air and natural gas or propane is passed. The hydrocarbons in the gas are cracked in the presence of the correct amount of oxygen from an atmosphere composed of carbon monoxide, hydrogen, and nitrogen.

The prepared atmosphere is piped to individual flowmeters mounted on the instrument panels adjacent to the furnaces. The piping was installed using tee fittings in place of elbows, and crosses where tees would normally be used, thereby allowing the lines to be inspected and cleaned of carbon deposits periodically.

The quality of the prepared atmosphere is controlled by controlling its dew point between 20 and 25 F. A dew point reading is taken at 2-hr intervals at the generator while it is in operation and at less frequent intervals of the gas that is actually in the furnace.

The endothermic generator gives trouble-free service if a good preventive maintenance program is followed and if the dew point is properly controlled.

Oil Quenching System. The details of a quenching system must be designed to fit the production demands and furnace capacities. When greater furnace capacity than is required for current production is available the quenching system should be designed for the maximum capacity of the furnace equipment. On the other hand, when there are plans to install additional furnace equipment, it is wise to size the quenching system to suit the maximum production demands that are forecast. An oil quenching installation suitable for the present furnace equipment, but with capacity for a higher production level than the department is presently being operated at, was designed for the installation described in this paper.

A quenching system capable of cooling a 3000-lb load of castings from 1600 F to 150 F every 3 hours was selected. An example of the simple computation used to determine the oil storage capacity and size of the oil cooling unit is as follows:[2]

(a) Determine the quantity of heat liberated by 3000 lb of steel.

$$3000 \times 0.166 \text{ (Sp Ht of steel)} \times 1450 \text{ (Temp drop)} = 720{,}000 \text{ BTU per load}$$

(b) Compute the minimum amount of oil required in the system, based on an allowable temperature rise of 30 F.

$$\frac{720{,}000 \text{ BTU}}{8.33 \text{ (Wt/gal)} \times 0.9 \text{ (Sp Gr, oil)} \times 0.5 \text{ (Sp Ht, oil)} \times 30} = 6400 \text{ gal}$$

(c) Compute the rate of oil circulation required, assuming the cooling rate of steel to be ½ in. per min.

$$\frac{6400 \text{ gal oil}}{3 \text{ min cooling time}} = 2133 \text{ gal per min}$$

(d) Compute rate at which the oil must be circulated through the cooler based on an average quenching rate of 1000 lb per hr.

$$\frac{6400 \text{ gal}}{180 \text{ min}} = 35.6 \text{ gal per min}$$

(e) The size of the actual quenching tank should be determined by the size of the largest furnace that is to be used. If a quenching tank is larger than is required, turbulance will be sacrificed.

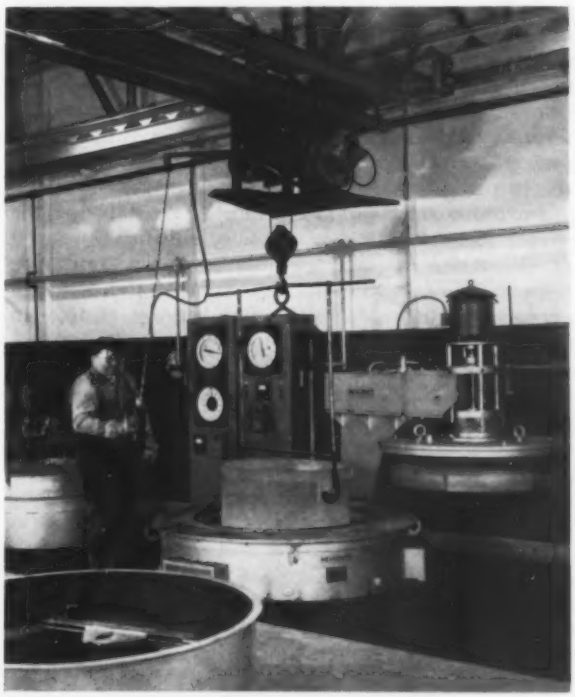


Fig. 7—Removing basket of cast gears at quenching temperature from electric pit furnace.

Fig. 8—Hot gears agitate quench water as they cool rapidly through critical temperature.

The layout of the oil quenching system (Fig. 5) is a side view of the system and does not show both oil pumps required to pump 2400 gal per min through the tank. Notice that the oil is taken from the side of the storage tank below the oil level so that a priming system is not required for the pumps.

A complete view of the oil quenching system is shown in Fig. 2. The cooling cycle includes a by-pass to allow the cooling oil from the shell and tube cooler to be circulated through the quench tank. All pumps are protected by a strainer located so that the strainer baskets can be withdrawn easily.

Water Quenching System. A combination storage and quench tank was selected to provide adequate water quenching capacity. As is shown in Fig. 6, 500 gal per min is supplied to the quench tank and 500 gal overflowed from the storage section; 1250 gal of water are circulated from the storage to the quench section each minute and a total of 1750 gal per min is passed up through quench and flows over the weir separating the two sections.

Since the water supplied from the river during the winter months is close to freezing, the storage section of the tank was equipped with electric resistance heaters. The water system has a capacity to quench in excess of 2000 lb per batch at an average of 1000 lb per hr.

Material Handling Equipment. The overhead handling equipment must of course be designed for the shape of the shop and with the layout of furnaces and quenching facilities in mind. In this case the crane is power driven on the tram rail whereas the hoist is moved manually. Bumper stops are provided on the crane to stop the hoist so that the hook lines up at the centerline of the furnaces and above the center of the quench tanks.

Two speeds are available on the hoist with the slow speed of 20 fpm used for movement in and out of the furnaces and the high speed of 51 fpm used for quenching. The hoist is equipped with a mechanical brake as a safety feature to be used in the event of a power failure while a hot load is being moved.

A basket loaded with cast gears is being removed from a furnace in Fig. 7. Notice the heat shield that protects the hoist motor from the radiation of the furnaces. Figure 8 is a view of the load being quenched and a fixture loaded with cast bevel gears is visible in the background.

Summary

The heat treating processes to be operated form the basis for selection of the equipment that is to make up the installation. The furnaces, quenching systems, and material handling equipment must then be engineered into a well integrated department.

The heat treating equipment described in this paper has made possible production of uniformly machinable castings for machining, and uniformly hard castings, free of scale and decarburization, when hardened after machining.

References

1. Peter Payson, *The Annealing of Steel.* Published by Crucible Steel Company of America, New York 20, N. Y.

2. "Oil Cooling Equipment," Bulletin No. FB-1052. Published by the Bell & Gossett Co., Morton Grove, Ill.

Convention Features Shop Courses

THE series of ten Shop Courses scheduled at the Cleveland Convention will provide valuable practical data for working foundrymen, metallurgists, and engineers. They will be held at night and there will be no admission fee or registration requirement.

Gray Iron. All Gray Iron Shop Courses will be held in the ballroom of the Hotel Cleveland at 8 pm, Monday, May 10; and in the Hotel Statler ballroom at 8 pm, Tuesday, May 11, and on Thursday, May 13 at the same hour. Discussion topics are:

Monday, May 10—Coke Screening and its Relation to Cupola Operation

Tuesday, May 11—Gating to Control Pouring Rate and its Effect on Casting Quality

Thursday, May 13—Cupola Bed Practice

Brass and Bronze. These Shop Courses will be held in South Hall 'B", Cleveland Public Auditorium at 4 pm, on Monday, May 10 and Tuesday, May 11.

Monday, May 10—Core Boxes, Ovens and Driers

Tuesday, May 11—Developments in Core Making

Sand. Shop Courses for the Sand Division will be held in the ballroom of the Statler on Monday, May 10, at 8 pm, and in the Statler Euclid Room on Tuesday, May 11 and Thursday, May 13 at 8 pm. "Fundamentals of Sand Control" is the theme for the entire course.

Malleable Iron. This Division is holding Shop Courses for the first time in many years. Two sessions are scheduled: at 4 pm, Monday, May 10, in South Hall "C" of the Public Auditorium; and on Tuesday, May 11, at 4 pm, in Club Room "A" of the Auditorium. Topics are:

Monday, May 10—Melting Malleable Iron

Tuesday, May 11—Malleable Annealing Practice

Refractories. "Importance of Refractories in Your Foundry" is the topic for this first Shop Course sponsored by this Division. It will be held at 2 pm, Thursday, May 13, in South Hall "B" of the Public Auditorium.

Producing Titanium Alloy Castings

MARVIN GLASSENBERG / *Assistant Metallurgist*

MORRIS J. BERGER / *Research Metallurgist, Armour Research Foundation, Chicago*

A furnace for melting and casting titanium has been developed and a number of industrially-important castings have been produced in zircon shell molds, dry silica sand molds, and graphite molds. Written discussion of this paper, Convention Preprint No. 54-35, should be sent to American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, Ill. The paper will be presented at a Light Metals Session of the AFS 58th Annual Meeting, Cleveland, May 8-14, 1954.

■ Within the past several years, a number of furnaces have been developed to melt and cast small amounts of titanium free from contamination. Small concentrations of oxygen, hydrogen, and nitrogen have a pronounced deleterious effect upon the physical properties of titanium. These elements, which normally come from the atmosphere, can readily be eliminated by employing an inert atmosphere or vacuum inside the melting chamber and mold. Contamination originating from the crucible presents a much more difficult problem, since no refractory material is known at present which will not react with molten titanium. A solution to this problem has been the use of a water-cooled metallic or refractory crucible protected by a layer of solid titanium between the crucible and molten charge (skull crucible). However, this method generally results in high power input, and possibilities of nonuniformity in alloy additions, due to the rapid extraction of heat by the cooled crucible.

The furnace discussed in this paper was patterned after the furnace described by Sutton et al. [1,2] and fabricated with the idea of having a practical furnace for studying and casting characteristics of titanium. Graphite was selected for the crucible material because of the relatively slow rate at which it dissolves in molten titanium. Up to about 15 pounds of titanium can be melted at one time in this furnace, and the carbon pick-up averages 0.7 per cent.

Various mold materials have been evaluated, including shell molds constructed from zircon, silica, and zirconia. A dry sand mix coated with colloidal graphite has been found to give good surface finishes. Castings produced in zircon shell molds coated with a heavy layer of colloidal graphite also give excellent surface finishes.

A source of difficulty in producing sound castings is the entrapment of the mold atmosphere (composed mostly of argon) by the incoming metal. This causes formation of gas pockets within the casting during solidification. Gases evolving from the binder in the sand are another source of trouble. The amount of gas trapped in the casting can be reduced by various gating, venting, and metal purging techniques.

Furnace: A cross-sectional view of the induction furnace is shown in Fig. 1, and the parts are itemized in Table 1. The furnace shown in Fig. 1 evolved through earlier models to facilitate handling and maintenance. Several slight modifications made on the furnace since the drawing was made are mentioned below.

A metal structure supports the furnace and permits operations to be conducted from one side. The power cables and water piping are brought in from the rear of the structure. The furnace was designed with a bottom tap hole to allow direct pouring into the mold below. The annular space between the retaining shell *B* and furnace case *C* is filled with lampblack *R*. This permits removal of the crucible from the furnace without disturbing the lampblack and furnace case.

The furnace is assembled for a heat in the following manner: (1) The crucible *A* is lowered into the furnace and the charge of titanium and alloy additions is introduced. (2) The crucible cover *D* is set in place and the furnace cover *E* is placed over the tie rods. (In earlier heats, as shown in Fig. 1, a refractory brick was placed between the crucible cover and furnace cover. However, the refractory brick was eliminated by increasing the height of the crucible cover so that the bottom of the furnace cover was flush with the top of the crucible cover. (3) The furnace cover is fastened down with the four springs *Z* and bolts.

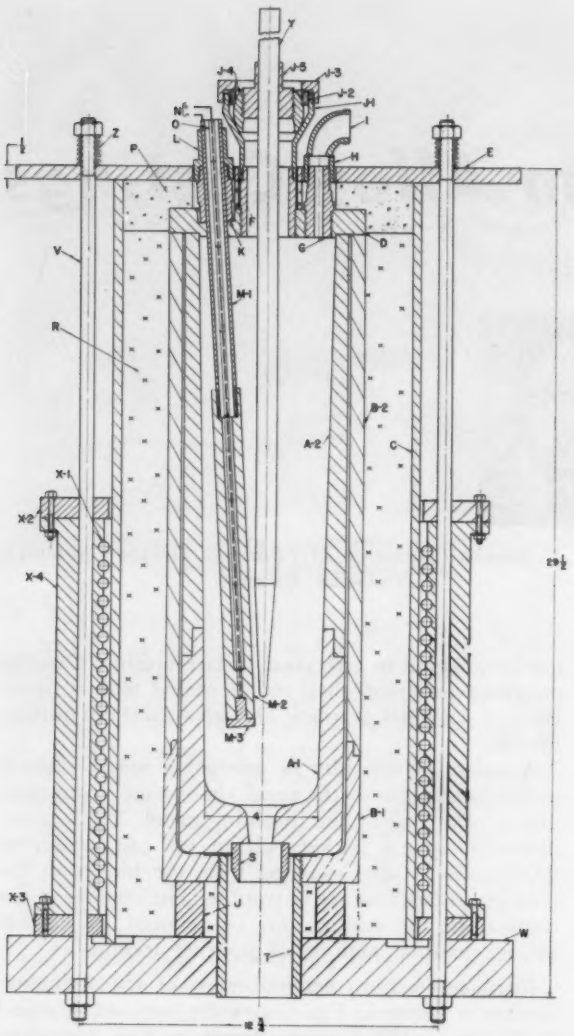


Fig. 1—Cross section of induction furnace. For legend, see Table 1 in right column.

TABLE 1—ITEMIZED LIST OF PARTS FOR TITANIUM FURNACE

Part No.	Name	Quantity	Material
A-1	Crucible, bottom	1	Graphite
A-2	Crucible, top	1	Graphite
B-1	Retaining shell, bottom	1	Graphite
B-2	Retaining shell, top	1	Graphite
C	Furnace case	1	Transite
D	Crucible cover	1	Graphite
E	Furnace Cover	1	Transite
F	Poke rod sleeve	1	Graphite
G	Argon inlet tube	1	Graphite
H	Coupling	1	Steel
I	90° elbow	1	Malleable iron
J-1	Swivel, body	1	Stainless steel
J-2	Swivel, gasket	1	Stainless steel
J-3	Swivel, cap	1	Malleable iron
J-4	Swivel, ball	1	Malleable iron
J-5	Swivel, poke rod adapter	1	Stainless steel
K	Target tube sleeve	1	Graphite
L	Target tube extension sleeve	1	Stainless steel
M-1	Target tube, top	1	Graphite
M-2	Target tube, bottom	1	Graphite
M-3	Target tube, plug	1	Graphite
N	Thermocouple	1	Tungsten-graphite
O	Thermocouple insulator	7	Recrystallized alumina
P	Refractory brick	1	Kaocast
R	Insulation	1	Lampblack
S	Pouring sleeve	1	Graphite
T	Retaining sleeve	1	Graphite
U	Crucible support	3	Graphite
V	Tie rods	4	Brass
W	Base	1	Graphite
X-1	Induction coil	1	Copper
X-2	Induction coil, top plate	1	Transite
X-3	Induction coil, bottom plate	1	Transite
X-4	Induction coil, support and spacer	3	Transite
Y	Poke rod	1	Graphite
Z	Compression spring	4	Steel

(4) The argon inlet tube is connected to the union elbow *I* and the poke rod swivel joint *J* is set in place. (5) The poke rod *Y* is passed through the swivel joint and supported outside the furnace until used for probing and tapping the charge. The assembly requires less than ten minutes to complete.

The induction coil is supported by steel cables and is guided by four brass tie rods to permit the coil to be raised and lowered. This is shown in Fig. 2. The coil is counterweighted so that it can be moved up and down with ease through a vertical distance of approximately 11 in. The furnace is normally operated at 3000 cycles using 65 kw.

Plugging the Crucible Tap Hole. Before assembling the furnace, the tap hole in the crucible is plugged with a granular graphite bot as shown in Fig. 3. The bot material consists of a mixture of 13.4 lb granulated graphite, 1.5 lb pitch, about 1400 ml water, and enough carbonaceous cement to form a spongy mixture. The bot material is rammed tightly into the tap hole, approximately ½ in. thick, and dried with a torch. When the charge is molten and superheated, the bot is driven out of the tap hole with the graphite poke rod and the metal discharges into the mold. A graphite strainer in a sand pouring cup catches the bot while allowing the metal to fill the mold.

Temperature Observations and Control of Superheat. The furnace shown in Fig. 1 contains a graphite tube, the lower end of which is closed and extends a short distance into the metal bath. Earlier attempts were made to sight on the bottom of the tube with an optical pyrometer. This method of observing temperatures was used for a number of heats, but the results were not uniform. The inconsistency was primarily due to magnesium chloride fumes evolving from the sponge titanium at elevated temperatures, and diffusing into the graphite target tube.

A later attempt was made to use a thermocouple consisting of tungsten wire and graphite. The tungsten wire, protected by recrystallized alumina tubing, was inserted into a graphite tube (Fig. 1) to form one of the electrodes. The graphite tube formed the other electrode, and the junction was the point of contact at the bottom of the tube. The thermocouple measured temperatures reliably up to the melting point of the charge. However, after the charge was molten, the emf generated by the thermocouple remained essentially constant, even though further heat was being supplied inductively to the charge. Therefore, super-

heat in terms of actual temperature could not be determined and the use of the carbon-tungsten thermocouple was abandoned.

The following procedure has been adopted in an attempt to control the amount of superheat given to the charge. The charge is first observed to be molten by probing with the graphite poke rod, and the time is recorded. Heating is continued to obtain a predetermined amount of superheat, and the metal is tapped from the crucible. Thus, superheat of the metal is measured by the number of kilowatt-minutes per pound of titanium absorbed by the liquid charge before tapping.

Titanium. The basic raw material used is commercially pure sponge titanium. Ingots of this material cast in a water-cooled copper crucible were found to have a Vickers hardness range of 140 to 180. The theoretical density of titanium is approximately 280 lb per cu ft, and the bulk density of the sponge was found to be about 48 lb per cu ft.

When a large charge of loose titanium sponge (greater than six pounds) was melted, the bottom of the charge became molten, but the top of the charge fused together to form a bridge across the crucible. This bridging occurred due to the temperature differential along the height of the crucible, and the poor thermal conductivity of titanium. Heavy blows with the poke rod were required to force the bridge down into the molten bath. To alleviate this condition, the titanium sponge was briquetted (3 in. diameter and about ⅝ in. thick), increasing the packing density to approximately 140 lb per cu ft. No serious bridging was observed when the charge consisted of all briquetted sponge or briquetted sponge used in conjunction with loose sponge.

In some of the recent heats where a large charge was required, the crucible was first charged cold with about six pounds of titanium and the furnace assembled. After the charge had reached its melting point and had dropped to the bottom of the crucible, additional titanium was introduced through the target tube sleeve *K*. During this operation, the argon flow was increased to prevent the entrance of air into the furnace.

In normal melting operations, the charge is melted with the induction coil in the lowest position, as shown in Fig. 1. However, in large heats where there is a tendency for the top of the charge to bridge, the induction coil is raised, as shown in Fig. 2. After the top of the charge melts, the induction coil is lowered. When alloy additions are made, they are usually in the form of fine powder or chips. The alloy addition is layered with the titanium to insure homogeneity and a lower melting point alloy throughout the charge. Commercially pure agents are used for alloy additions.

Mold Materials. In general, three types of material were used for molds. These were graphite, dry sand, and resin bonded sands. In a number of molds, a combination of graphite and dry sand was used. In general, a sand pouring cup containing a graphite strainer is placed on top of the mold to direct the metal into the cavity and to prevent the bot material from entering the mold.

Graphite molds were constructed from standard

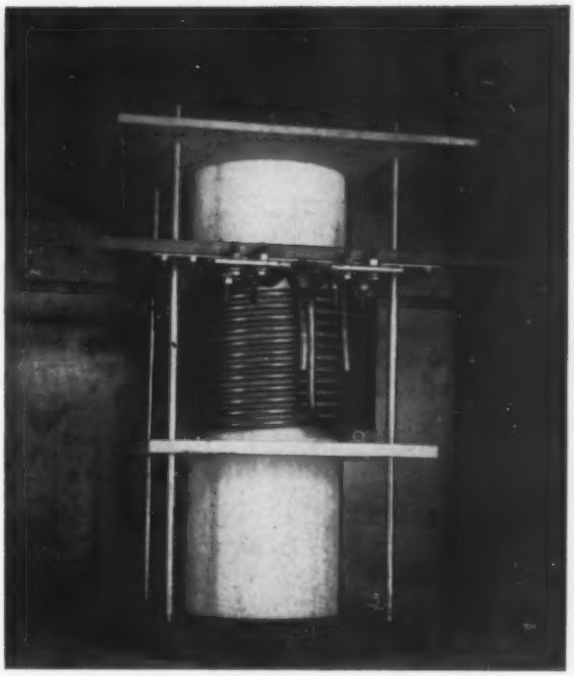


Fig. 2—Induction coil, showing adjusting equipment.

graphite pipe, graphite plates, or machined from solid stock. A number of dry sand mixes have been investigated; No. 11 listed in Table 2, has been found to give good results. Improved results were obtained when the baked sand mold was coated with a brushed proprietary graphite wash, and baked to remove moisture and solvents. The time lapse between drying the coated sand mold and pouring the casting was

TABLE 2—NO. 11 DRY SAND MIX

Material	Per Cent
Core Oil	1
Silica Flour	5¾
Pitch	1¾
Royal Binder	2¾
Cereal Binder	½
Water	3½
Silica Sand (GFN 81)	Remainder

kept to a minimum. Three sands, silica, zircon, and zirconia, were investigated for the base sand for shell molds. To minimize gas pick-up, only 2½ per cent phenolic resin was used as the binder.

Excessive pin-holing was found on castings produced in silica shell molds and the material was abandoned. Zircon and zirconia shell molds, coated with a heavy layer of graphite wash, produced some sound castings. However, no essential difference was noted between castings produced in zircon and zirconia and the use of zirconia was discontinued. Unless otherwise stated, zircon shell molds coated with a heavy layer of graphite wash were used to produce the castings discussed in this paper. In addition, all the shell molds utilized a No. 11 sand mix pouring cup coated with a graphite wash. In several cases, composite molds consisting of shell molds and No. 11 sand mix cores were assembled.

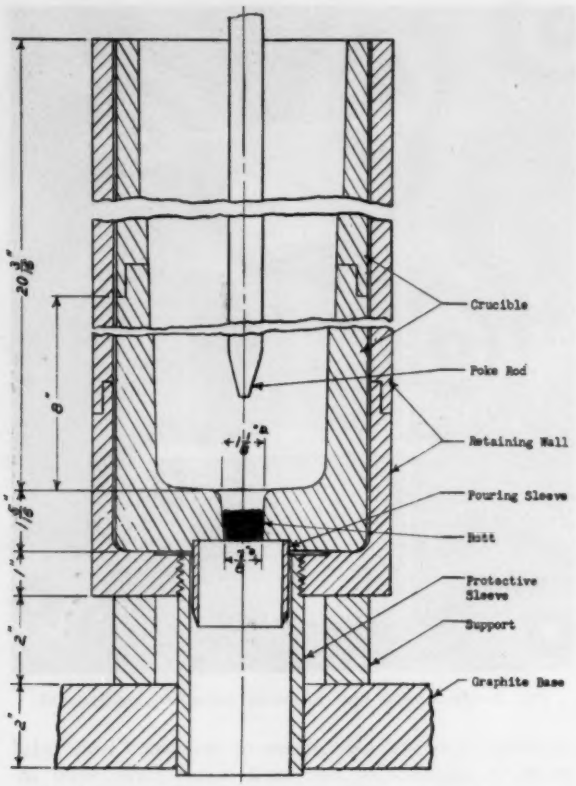


Fig. 3—Cross section, showing location of granular graphite bot in crucible tap-hole.

In these molds, the latter was utilized to form mold components where shell molding was impracticable.

Experimental Results. The information obtained in the production of several industrial castings in shell molds and the basic facts derived from earlier casting work will be discussed. The results cover the work of over 200 separate heats. The industrial castings include

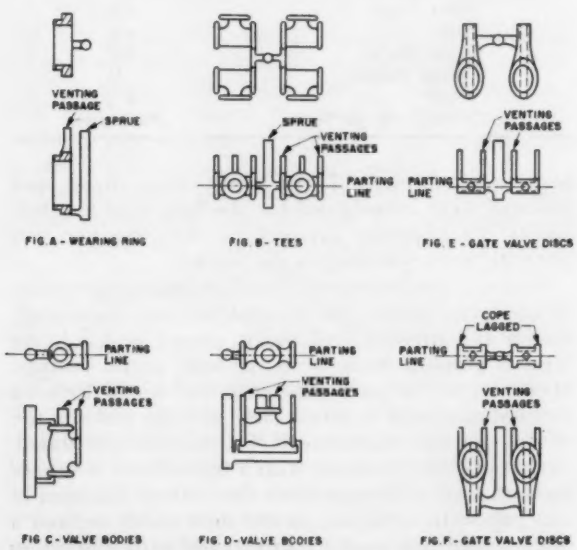


Fig. 4—Gating and venting systems used to cast rings, valve bodies, and fittings in No. 11 dry sand mix.

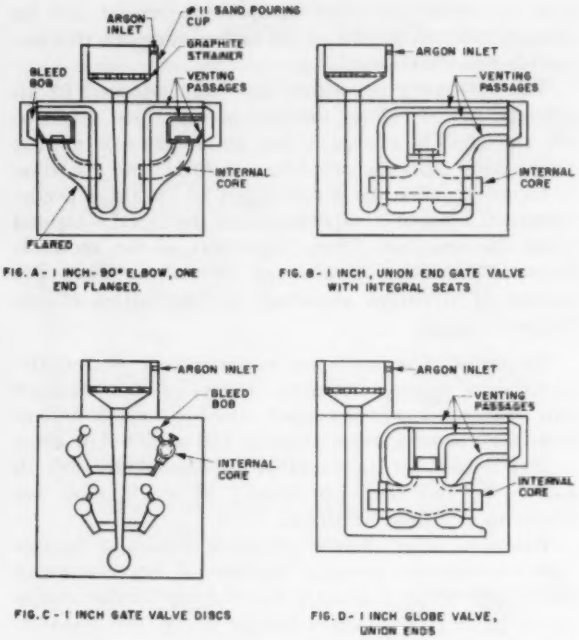


Fig. 5—Gating and venting systems used to cast valve bodies and fittings in shell molds.

seating rings, gate-valve bodies, gate-valve discs, globe valves, pipe tees, and elbows.

The initial venting of the gating systems used to produce these castings is shown in Fig. 4. At the time these methods were tried, No. 11 dry sand mix was used to make the molds. Many variations of these systems were tried, ultimately resulting in those shown in Fig. 5. Zircon shell molds and internal cores were used to cast most of the above mentioned valves and fittings except in the case of the globe valve. In this case, the internal core was made of two parts; one was made from No. 11 sand mix and the other from resin-bonded zircon sand.

The most common defects encountered were cold shuts and gas holes. These defects were noted in castings produced in both sand and machined graphite molds. In the latter, elimination of cold shuts and entrapped gases was difficult, due to the strong chilling action and negligible permeability of graphite. The surface of a 4.5-lb charge cast in a graphite pipe mold is shown in Fig. 6. Although sound castings were produced in graphite, other mold materials were investigated due to the expense of machining graphite molds.

Venting. The primary sources of gas holes were found to be entrapped bubbles of the mold atmosphere, and gases formed by thermal decomposition of the mold binder blowing into the cavity or casting. Due to the low density of titanium, gas bubbles, once formed, floated to the surface slowly, and solidification was frequently complete before the gases were expelled from the casting. To minimize entrapment of mold gases, it was found necessary to amply vent every cope surface of the mold cavity. It was frequently necessary also to attach one or more bleed bobs to the vent holes so as to purge the mold cavity of gas bubbles by

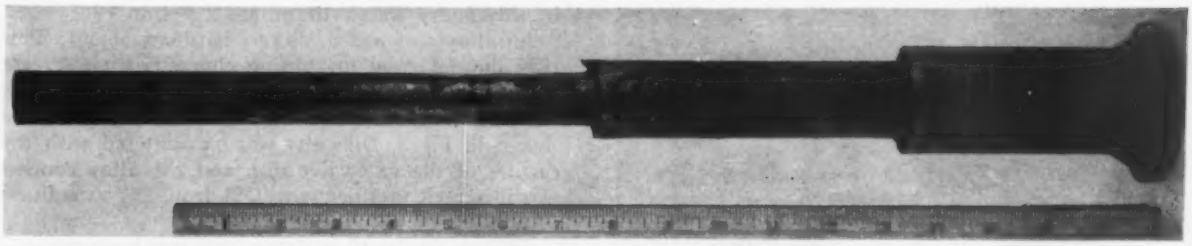


Fig. 6—Casting produced in graphite pipe mold.

passing a small amount of metal through the casting into the bobs. This is shown in the mold setups in Fig. 5.

Internal cores constituted a second major source of defects. Gas holes were generally found on the bottom of the internal core, since bubbles were here prevented from floating to the mold vent holes. Where possible, internal cores were heavily vented; this precaution decreased the incidence of blow holes but did not eliminate them. The defects shown on the globe valve casting in Fig. 7 (cast in a zircon sand mold) were due to one or both of the above causes.

The inherent permeability of shell molds makes them valuable as a mold material for casting titanium, since the thin shell permits easy escape of all mold gases. Whenever possible, the internal cores are made hollow and are vented to the outside of the mold.

In order to minimize gas generation originating from the binder burning out when the molten metal comes in contact with the sand, shell molds were made with a minimum amount of resin. Good shell mold reproductions of the valves and fittings were found possible with only 2½ per cent resin.

Gating. Since carbon pick-up is a function of the time the charge is held molten in the crucible, superheat is held to a minimum. This in turn requires that the lengths of runners and ingates be held to a minimum. Whenever possible the ingates are choked to allow the metal to enter the mold with a minimum of turbulence and entrapment of the mold atmosphere.

The experiences obtained with a variety of gating systems can be summarized as follows: (1) Bottom gating is preferable, if not mandatory. (2) Gates should be located so that no abrupt changes in direction occur in metal flow immediately beyond the point of entry. Thus, better results were obtained when the 90 degree bend in the ingates was removed in Fig. 5b, as compared to Fig. 4d. (3) The metal should be prevented from dropping into the cavity. Thus, in Fig. 4d, the globe valve was originally gated from the two flanges only, and the metal actually dropped down into the middle portion of the valve. Valves cast in this manner contained excessively pitted areas at the bottom of the valve. To alleviate this condition, a center ingate was added as shown in Fig. 5d. (4) Use of large rounds and fillets instead of sharp corners or abrupt changes is of extreme importance in obtaining sound castings. In many cases, pitted areas were almost entirely eliminated by utilizing this practice. An example of this is shown in Fig. 5a, where the section leading from the flange to the body was flared to improve feeding. Prior to flaring this section, the castings contained cold shuts on the body and pitted areas between the flange and body.

Fig. 7—Globe valve body, showing gas entrapment under internal core. Cast in zircon sand mold.

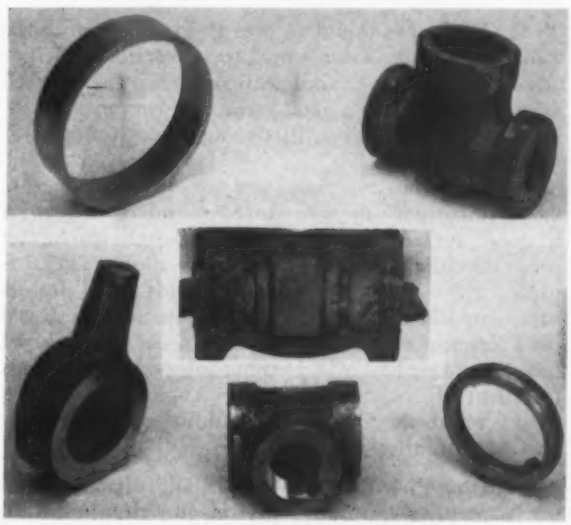


Fig. 8—Titanium-iron-vanadium alloy castings produced in No. 11 dry sand mix molds and internal cores.

Effect of Alloying Elements. In all but a few cases, cold shuts were present in castings produced with unalloyed titanium. However, as alloying additions were made, cold shuts were eliminated. The maximum and minimum Vickers hardness readings on unalloyed titanium castings were 303 and 175, respectively, and the average hardness for fourteen heats was 255. The low hardness values were usually obtained in graphite molds.

A number of titanium alloys were cast. These included: Ti-1 to 3% Fe, Ti-1.2 to 3% Fe-0.8 to 2% V, Ti-2% Cr, Ti-15% Cr, Ti-4% V, Ti-2% V-4.3% Al, Ti-5% Ta-4% Al, Ti-1.5 to 8.5% Si, Ti-7% Mn, Ti-8.5% Cu, and Ti-36% Al. The Ti-Fe, Ti-Fe-V, and

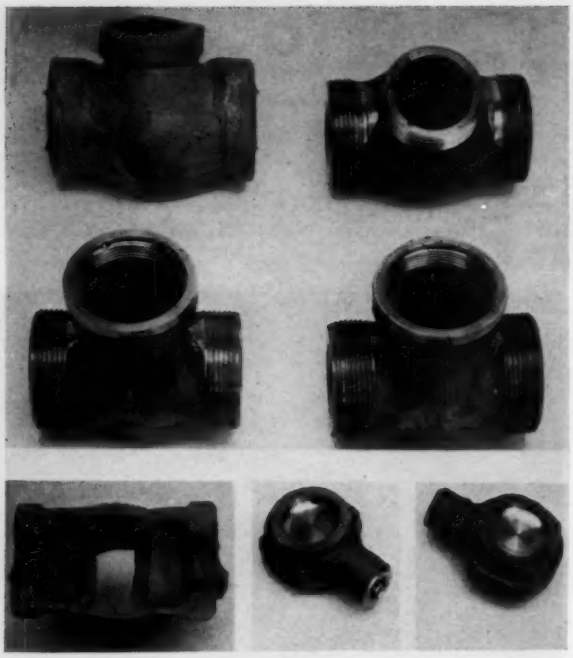


Fig. 9—Titanium-iron-vanadium alloy castings produced in zircon shell molds.

Ti-Si alloys were found to give good surface finishes. The other alloys were found to be of no particular advantage. The titanium-silicon alloys produced sound castings with a good surface. However, the castings were extremely brittle and machining was difficult.

The titanium-2% iron and titanium-1.2% iron-0.8% vanadium alloys produced sound castings with a good surface finish and had better machining properties than the titanium-silicon alloys. The titanium-1.2% iron-0.8% vanadium alloy had slightly better melting and casting characteristics, and was used for most of the castings made. Castings produced from this alloy had a Vickers hardness of 315 (average for 10 heats).

In general, the fluidity or castability of titanium increased with alloy additions.

Impurity Pick-Up. The carbon and nitrogen pick-up in melting titanium-2% iron and titanium-1.2% iron-0.8% vanadium alloys average 0.70 and 0.055 per cent, respectively (both values are an average of 10 heats). Recently, a titanium-2% iron alloy was cast in a graphite pipe to determine the mechanical properties. The average iron, carbon, and nitrogen content was actually 2.02, 0.78, and 0.053 per cent, respectively. The as-cast bars elongated between 2 and 3 per cent (1-in. gauge length), and had a tensile strength of about 105,000 psi. This agrees with the elongation values found by Simmons and Edelman for titanium-0.7 to 0.8% carbon alloys. Heat treatment did not improve the ductility of the bars.

Castings. Castings produced in No. 11 core sand molds and internal cores coated with a graphite wash are shown in Fig. 8. The gating and venting systems for these castings are shown in Fig. 4. The ring shown in this figure was a titanium-1.2% iron-0.8% vanadium alloy and had a Vickers hardness of 301. This ring showed good machining characteristics. A gate valve body casting and a cross-section of a valve body showing the soundness of the metal cast are also shown in Fig 8. Difficulty was encountered with the casting of the gate-valve disc and the alloy content was increased to 5 per cent (3% iron, 2% vanadium) to produce the disc in Fig. 8.

Castings produced in zircon shell molds coated with a heavy layer of graphite wash are shown in Fig. 9. The gating and venting systems for these castings are shown in Fig. 5. Almost all of the castings produced in zircon shell molds had a good finish, although in a number of cases one or several gas holes were present in sections of the casting that were difficult to vent. The defects in Fig. 7 illustrate this point. However, the occurrence of gas holes was sporadic; identical gating and venting systems produced some sound valve bodies and others that had one or more gas holes.

Conclusions

1. A furnace has been developed which permits the convenient melting and casting of titanium in an argon atmosphere. Mechanical operation has been simplified and standardized so that a minimum supervisory effort and maintenance are required.

2. A zircon shell mold bonded with approximately 2½ per cent resin and coated with a graphite wash was found to produce good finishes and relatively sound castings. A dry sand mix has been developed which can be used in conjunction with shell molds. The material can be used for pouring cups and to make component parts in molds where shell molding is not practical.

3. A number of castings of industrial significance have been successfully produced. These include gate-valve bodies, gate-valve discs, gate-valve seating rings, sealing rings for centrifugal pumps, globe valves, and pipe tees.

4. A titanium-1.2% iron-0.8% vanadium alloy has been found to have good fluidity and castability characteristics, and castings produced with this alloy were machinable.

Acknowledgments

The authors express appreciation to the Bureau of Ships for permission to publish the results on the work sponsored under Contracts No. Nobs-54299 and NObs-61229. Acknowledgment is also given to J. Giddens, L. L. Clark, and G. W. Johnson for their helpful suggestions. The authors also wish to thank J. Dorcic and M. M. Ivans for their aid in the laboratory work.

Bibliography

1. J. B. Sutton and T. D. McKinley, "Induction Melting of Titanium in Graphite," *Metal Progress*, vol. 55, no. 2, Feb. 1949, p. 195.

2. J. B. Sutton, E. A. Gee, and W. B. Delong, "Casting and Forging of Titanium," *Metal Progress*, vol. 58, no. 5, Nov. 1950, pp. 716-720, 720B.

3. O. W. Simmons and R. E. Edelman, "Mechanical Properties of Cast Titanium-Carbon Alloys," TRANSACTIONS, AFS, vol. 61, pp. 411-415 (1953).

Gating and Risering of Magnesium Alloys—Part 2

H. E. Elliott / *Metallurgist, Dow Chemical Co., Bay City, Mich.*

Successful risering techniques are described in this part of a paper telling how to minimize defects in magnesium alloy castings. Part 1 on gating appeared last month. Written discussion of this paper, Convention Preprint No. 54-42, should be sent to American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, Ill. The paper will be presented at a Light Metals Session of the AFS 58th Annual Meeting, Cleveland, May 8-14, 1954.

■ The foregoing sections of this paper have dealt with the mold-filling stage of the casting process, and with the avoidance of defects originating in that stage. An equally important stage of the casting process is the solidification period. As the metal passes from the liquid to the solid state, it contracts in volume. Provisions must be made to compensate for this shrinkage contraction; otherwise a number of so-called shrinkage defects may occur. These include shrinks, which occur while the metal is still very largely in a liquid state; draws and microporosity, which occur after solidification has progressed considerably; and cracks and warpage, which occur when the metal is almost completely solidified or later. The following sections will deal with these defects, their causes, and measures that are useful in correcting them.

Riser Fundamentals. In discussing the solidification process, it is helpful to visualize the mold at the moment of complete filling of the mold cavity, and consider in sequence the phenomena that occur as the metal loses its heat to the mold material.

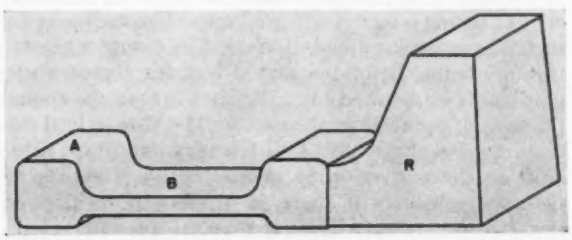


Fig. 7—Riser cannot feed section A after section B freezes. To produce a sound casting, order of freezing must be A, B, finally R.

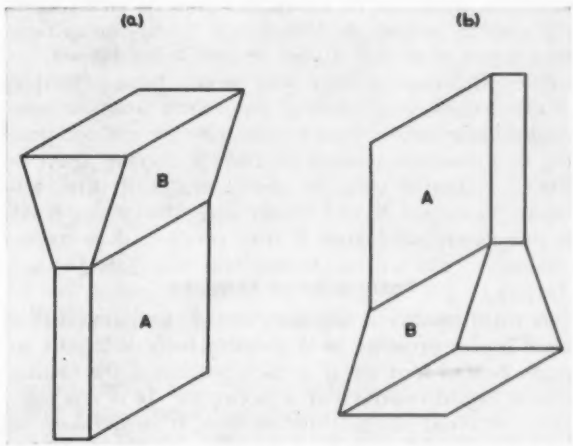


Fig. 8—Importance of gravity to fluid metal flow in early stages of solidification. Riser B (right) will not feed casting A.

During the first part of the solidification process, the liquid metal cools to the point where solidification begins; there is a contraction in liquid metal volume during this period. A mold cavity that is completely full at the moment of completion of the pour obviously will be something less than completely full after this shrinkage contraction has taken place; hence the need for risers on the casting. If the casting is to be free of shrinkage voids, there must be a supply of liquid metal to compensate for the contraction in volume of the liquid in the casting cavity.

To be an effective source of feed metal, the riser must be the last portion of the casting to solidify. The riser obviously must be able to supply liquid feed metal as long as any liquid shrinkage is taking place in the casting itself. This may be regarded as the first and most basic principle of risering—that the riser must be the last portion of the casting to solidify.

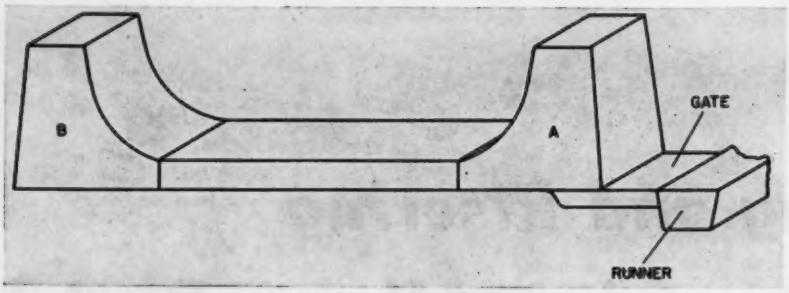


Fig. 9—Metal in risers B and A will be at different temperatures and cool at different rates because gate connects directly to A.

While this is a necessary condition to the effectiveness of a riser, it is not in itself a sufficient condition to ensure that the riser will feed the casting effectively. Not only must the riser be the last part of the casting to solidify, but there must be a progressive solidification of the casting starting at points farthest from the riser and continuing progressively from point to point toward the riser, until solidification is complete. Referring to Fig. 7, it is evident that the riser *R* cannot effectively feed section *A* of the casting if section *B* solidifies while section *A* is still liquid. When section *B* solidifies, there can be no further flow of metal from the riser to section *A*. Hence any liquid contraction that occurs in section *A* after section *B* is solid will result in shrinkage cavities. The second basic principle of effective risering, then, is progressive solidification, beginning at points remote from the riser and continuing in a direction toward the riser. Referring again to Fig. 7, section *A* must be caused to solidify first, followed by section *B*, and finally, after the casting itself is completely solid, riser *R* may be allowed to freeze.

Positive Force Required

A third condition necessary to the effectiveness of a riser is the presence of a driving force sufficient to cause flow of feed metal to each portion of the casting where liquid contraction is occurring. It is not sufficient to avoid obstructions to flow; it is necessary to provide a positive force that will cause flow to occur. This can be illustrated with reference to Fig. 8a and 8b. Consider, in each diagram, that *A* is the casting to be fed, and that *B* is the riser. In each case, the dimensions of *A* and *B* are identical; in each case, assume thermal conditions to be ideal, with solidification beginning at the point farthest from the riser, and progressing without reversals from point to point toward the riser. The only difference is that in *a*, the riser is above the casting, while in *b*, the riser is below the casting.

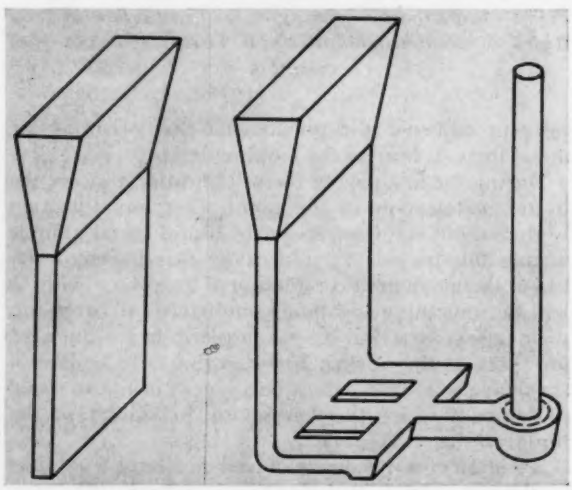


Fig. 10—(left)—Top pouring, ideal for this casting from thermal standpoint, cannot be used because inclusions may result. Fig. 11 (right)—This gating system avoids inclusions but gives poor feeding because the coldest metal is in the riser.

In case *a*, from the moment the mold filling is complete and shrinkage contraction begins, there is a gravitational force promoting flow of feed metal in the direction from riser *B* to casting *A*. In case *b*, the opposite is true. While there is no physical obstruction to flow in the direction from riser *B* to casting *A*, neither is there a driving force leading to flow in the direction from *B* to *A*. It is very likely that in the early stages of solidification, liquid metal will drain from casting *A* to compensate for the contraction of the large volume of metal in riser *B*, unless definite provisions are made to provide a force promoting flow in the opposite direction.

In the very early stages of the solidification process (i.e., before solidification has proceeded very far and the casting is still largely fluid), gravity is the primary force influencing the feeding of the casting. Later, when solidification has progressed to the point where a partly solid structure has formed, other driving forces come into play. Chief among these forces promoting flow of liquid through the interstitial channels in the partly solid structure are atmospheric pressure and surface tension. A highly detailed discussion of these forces is beyond the scope of this paper.

Temperature Gradients and Flow

An important principle regarding the practical utilization of these forces, however, is this: The forces that promote flow of feed metal are increased by the existence of strong temperature gradients. The resistance to such intergranular flow is decreased by strong temperature gradients. It follows that if a strong temperature gradient is established from the riser toward the cooler portions of the casting, the riser will be able to feed the casting more effectively. This is a very important principle in the correction of microporosity, a shrinkage defect that occurs if there is insufficient feeding of liquid through the channels that are present among the dendrites of solid metal late in the solidification process.

The basic principles governing the risering of cast-

ings are extremely simple. The establishment of directional solidification, starting at points farthest from the riser and progressing, without reversals, and with a strong temperature gradient, toward the riser, with the riser itself being the last portion of the casting to freeze are the conditions that result in effective risering. While simple in principle, some ingenuity is required to achieve them in practice. General principles and devices for producing the desired conditions are to be described in subsequent sections.

Riser Massiveness. It has been stated that the first basic requirement of an effective riser is that it freezes last, after the casting is completely solid. What devices are available to secure this result? The first and most basic control that can be exerted to produce this result lies in the relative massiveness of the casting section to be fed and that of the riser. This is a simple concept. It seems obvious that a more massive section will cool more slowly than a lighter one. This does not necessarily mean that the riser must weigh more than the total weight of the casting it feeds, but it does mean that the weight of metal in the riser must be concentrated within a relatively smaller volume.

This principle has been stated in various ways. One way of stating it would be to say that the riser should have a large ratio of mass to surface area compared with this ratio for the casting. Another way this concept has been stated is by saying that it should be possible to inscribe a larger sphere in the riser section than in the section of the casting to be fed. These are rather involved ways of expressing a principle which is really not complex enough to require an involved description. The simplest way of thinking of it is to make the riser chunkier than the casting section to be fed, so that it will lose temperature more slowly than the casting.

Flow Patterns. Simply making the riser chunkier than the casting it feeds is not sufficient, however, to ensure that the riser will freeze last. The flow patterns in the filling of the mold are also important. Consider the casting in Fig. 9. The casting proper is a simple flat panel of uniform section. There is a riser *A* at one end and a riser *B* of identical size and shape at the other. The mold is filled by ingates into riser *A*.

It is apparent that, at the moment the filling of the mold is complete, the metal in riser *A* will be hotter than that in riser *B*. The metal that has arrived in riser *B* was subjected to the cooling effect of flow through the thin wall of the casting. In contrast, the metal that filled riser *A* entered directly from the gate. The metal in riser *A* will also tend to cool more slowly than that in riser *B*, because in the filling of the mold, there was considerable flow of metal over the mold material adjacent to riser *A*, whereas there was little flow of metal over the mold material near riser *B*. It is evident that despite similar dimensions, the two risers will be at different initial temperatures and cool at different rates, as a result of the particular flow patterns in the filling of the mold.

In the case illustrated, it is even possible that certain portions of the casting itself may remain liquid after riser *B* has frozen. Specifically, the solidification of the portion of the casting quite close to riser *A* will tend to be retarded. This portion of the casting is close to the hot riser *A* and it is surrounded by mold material which was preheated by the flow of much metal over it. These factors tend to keep this portion of the casting hot. Meanwhile, the metal that was pushed up into riser *B* had already given up much of its heat in travelling to its final position in the mold. It came to rest in contact with cold mold material that still retained its heat absorbing capacity. Despite the relative chunkiness of riser *B*, it is likely to lose temperature rapidly by virtue of these conditions.

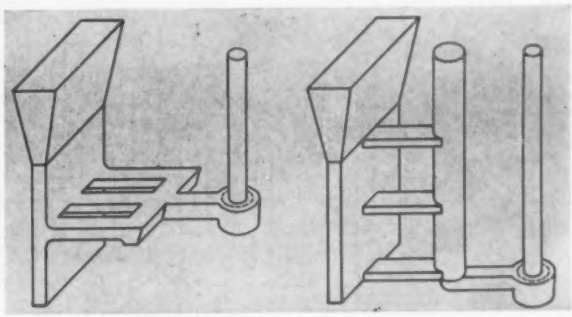


Fig. 12 (left)—Middle gating, a compromise between top and bottom gating, is not desirable because metal is subjected to tumbling action in mold cavity. Fig. 13 (right)—Step gating works if flow pattern in upper gates is not established prematurely or is set up in reverse direction.

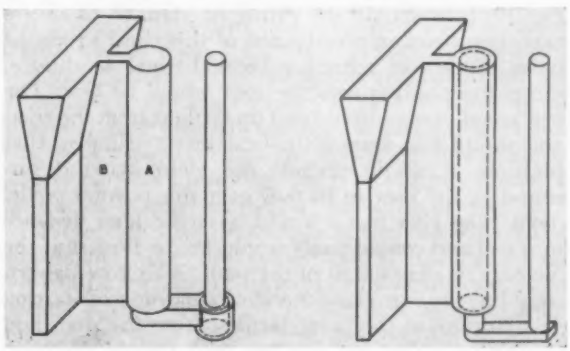


Fig. 14 (left)—Slot gate assumes vertical flow in cylindrical well A and horizontal flow through B. Fig. 15 (right)—Tabular screen in cylindrical well guarantees horizontal flow through slot gate as metal rises.

It is a great fallacy to assume that simply making the riser chunkier than the casting will ensure that the riser will freeze last. A completely different pattern of solidification may result in a casting than would be predicted purely on the basis of the relative section thicknesses involved. Many shrinkage defects that at first appear to contradict the principles of directional solidification are understood if recognition is given to the effect that flow patterns may have on the actual temperature conditions in the solidifying casting.

Flow Patterns in Vertical-Walled Castings. Castings that have considerable vertical depth pose an interesting problem in achieving favorable flow patterns. As brought out earlier, bottom gating of magnesium alloys is conducive to greatest freedom from inclusions. Bottom gating does not lead to the most favorable thermal conditions, at least in the case where top riser-

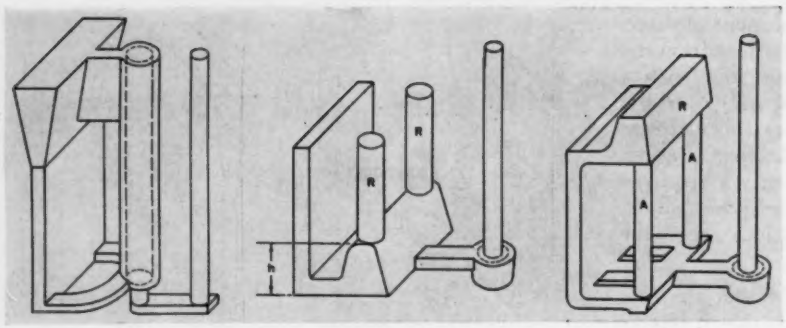


Fig. 16 (left)—Concentric tabular screen permits wide variety of ingates to be used successfully without premature flow into ingates at higher levels. Fig. 17 (center)—Bottom riser, assisted by gravity feed of cylinders R, supplies hot metal to vertical-walled casting. Coldest metal rises to top of mold cavity, promoting favorable thermal gradients. Fig. 18 (right)—Side risering with bottom gating attempts to put hot metal in riser R by way of Channels A.

ing is necessary or desired. Consider a simple vertical panel as a typical element of a deep vertical-walled casting, and examine the modes of filling and risering this casting cavity.

Assume first that the panel is to be top risered as in Fig. 10. How should the gating be planned to ensure maximum feeding effectiveness of this riser? From the point of view of achieving ideal thermal conditions, direct top pouring into the riser would be best. The first metal poured would end up farthest from the riser, and would lose some of its heat in travelling to that position. It would preheat the mold material surrounding the riser in its flow over this portion of the mold. The riser metal would have the least distance to travel and consequently would be the hottest at the moment of completion of the pour. This flow pattern would serve to promote the ideal condition of starting solidification at the point farthest from the riser, and promoting progressive freezing back toward the riser.

Hottest Metal Remote From Riser

Of course, this method of pouring a magnesium casting is ruled out by considerations of avoiding casting inclusions. If avoiding dross inclusions were the only important consideration, a natural way to fill the cavity would be by bottom gating, as indicated in Fig. 11. But note that the flow patterns created by this gating method are completely opposed to the establishment of the desired thermal conditions. With this gating, the coldest metal comes to rest in the riser; the hottest metal at the point farthest removed from the riser. The mold material in contact with the casting is preheated by the flow of much metal over it while that surrounding the riser is relatively cold at the moment of completion of the pour. All of these conditions tend to retard the solidification of the casting and accelerate the solidification of the riser. By making the riser sufficiently massive, it may be possible that these initial adverse thermal conditions may be reversed early enough so that the riser will freeze last. At best, however, thermal gradients during the critical solidification range will be weakened if filling patterns are thus unfavorable.

A number of expedients have been proposed to reconcile these divergent interests of producing filling conditions that will both achieve good freedom from inclusions and promote favorable thermal conditions. A compromise solution might be represented by Fig. 12. In practice, any drop of metal from one level to a lower level in the casting cavity carries with it the danger of forming inclusions, and for this reason the author has not found this "middle gating" principle useful in practice.

Step gating, as represented in Fig. 13, has been proposed as a possible solution. Research[5] at the Naval Research Laboratory has been directed at perfecting this method for ferrous metals. Apart from the expense entailed in molding this type of gate, there is a serious technical objection. One cannot be sure that the higher ingates will actually be operative in the filling of the mold.

The first metal will necessarily enter the lowest ingates, and the bulk of flow in the entire filling of the casting may continue through this preheated path. If the lower ingates are choked down in the attempt to avoid this effect, there may be a premature flow through the upper gates, resulting in a drop of metal within the casting cavity. Thus, a delicate balance must be achieved for the step gating principle to work, and the exact geometrical conditions to achieve this delicate balance are not readily arrived at.

The slot gate is represented in Fig. 14. The easy machining of magnesium and the utility of this gate in solving certain feeding problems have made it a popular gate for magnesium. In using this gate, a filling pattern is visualized whereby there is substantially a vertical flow of metal in the cylindrical well *A* and a horizontal flow of metal through the slot into the casting cavity. Actually, there is no assurance that this type of flow will occur. The initial flow of metal will be by entry into the base of the casting cavity, and the bulk of later flow may continue to follow these paths that are established early in the pour.

Screen Controls Filling Patterns

The slot gate can be made positive and effective in its promotion of proper filling patterns by the incorporation of a tubular screen,[6] as shown in Fig. 15. The tubular screen is effective in producing horizontal flow of metal in the slot at each new level that the metal attains; thereby, the casting cavity is filled esesntially by the depositing of successive layers of hot metal at successively higher levels in the casting cavity, with the riser filling directly from the gating system. If the screen diameter is large in relation to the rate of delivery of metal to it, there is an effective filtering action by the screen and a quiet flow of clean metal into the casting. There is no drop of metal within the casting cavity. The method satisfies successfully the various conditions desired both for maximum cleanliness and best thermal conditions for casting soundness.

In using the cylindrical well with its concentric

tubular screen, there is no need to confine the shape of the ingate to the vertical slot configuration. Bottom gating with hot shots to the riser, as in Fig. 16, is common. Step gating at any level is feasible. The well may be used as a riser, with junctions into various sections of the casting at intermediate levels. In use, it is found that premature flow into the ingates at the higher levels is not a problem, yet these higher ingates definitely become effective as paths of flow when the metal reaches their level in the mold. This gating device is recommended as an adaptable and highly useful solution in a great number of mold filling and feeding situations.

Bottom Feeding. The problem of getting hot metal into a top riser without flowing the riser metal through the casting can sometimes best be solved by eliminating the top riser. Figure 17 shows the application of a bottom feeder to a simple vertical panel. It is readily seen that especially favorable thermal gradients are promoted by this method of gating. There is a minimum of flow of metal through the casting cavity. The coldest metal ends up at a point most distant from the riser. The riser itself fills directly from the gate. Note, however, that the riser openings *R* are essential to the successful functioning of a bottom feeder.

They serve two vital purposes. First, they provide the driving force promoting flow from the riser to the casting early in the cooling process. The metal in the riser begins to lose heat and contract in volume as soon as the pour is complete; if the openings *R* were not present, there would be a drainage of liquid metal out of the casting under the force of gravity to compensate for this contraction, resulting in shrinkage defects. If the bottom riser is generously backed up by the openings *R*, however, the latter will supply the liquid needed to compensate for the shrinkage of the bottom riser, and a static pressure of the metal against the walls of the mold will be maintained until the casting has had time to solidify.

Improper thermal conditions for feeding will also result if the riser openings *R* are omitted. Visualize the flow conditions that result from the omission of these openings. When the metal has reached height *h* in the mold, the riser is full, and begins to lose heat to the surrounding mold material. Meanwhile, flow continues through the base of the casting until the mold is entirely full. At the moment of complete filling of the cavity, the metal at the base of the casting is extremely hot, and it is surrounded by mold material that has been preheated by flow of metal over it. The metal in the riser has been stagnant for an appreciable period, and has lost much of its heat to the surrounding mold material. This can result in the solidification of the riser earlier than the metal in the base of the casting cavity, with the formation of shrinkage defects in the last metal to solidify.

The presence of the riser openings *R* assures that flow will continue through the riser as long as there is flow into the casting. This keeps the riser hot and open and allows it to stay liquid long enough to effectively feed the casting. It can be stated as a generalization that blind bottom feeders into the base of a deep vertical-walled casting are seldom effective; they can often be made effective by extending their height; sometimes they must extend the full height of the casting.

Bottom risering is not always applicable as an alternative to top risering; often there is a section near or at the top of the casting that is too massive to be fed through the casting and must be risered directly. Figure 18 illustrates what might be termed side risering with bottom gating. An attempt is made to fill the riser directly from the gating, so that the riser metal does not flow through the casting cavity. Sometimes this device can be employed effectively, but there is never complete assurance that the upright runners *A* will actually be operative in the filling of riser *R*.

It is seen that the planning of the gating of a casting to promote proper flow patterns is a complex problem, for which no simple formulas can be offered. The specific design of the part will have a major bearing on the selection of the best method; there is also much room for the exercise of individuality and good judgment on the part of the foundryman.

Riser Spacing. The question of how many risers to use and how far apart to space them is one that must be decided in planning the rigging of a casting. A discussion of risering practice should cover this subject and offer any useful generalizations that are known. It is difficult to offer quantitative generalizations as to riser spacing for this reason: In general, the heavy sections of a casting are risered; if these are fed adequately, the adjoining webs, ribs, and connecting walls get sufficient feed metal from the risered heavy sections to satisfy their needs. The spacing of the heavy sections of a casting is fixed by its function, and usually cannot be greatly modified to facilitate the casting of the part.

In a casting of intricate design, it is obviously not possible to feed by a separate riser every boss, flange,

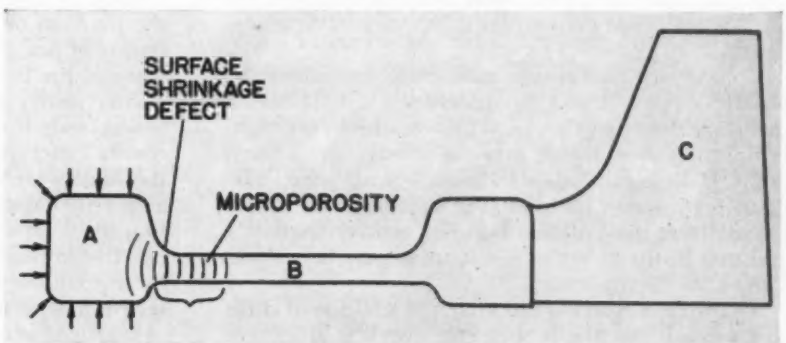


Fig. 19—Cross section of casting in Fig. 7, showing where defects may occur with inadequate feeding.

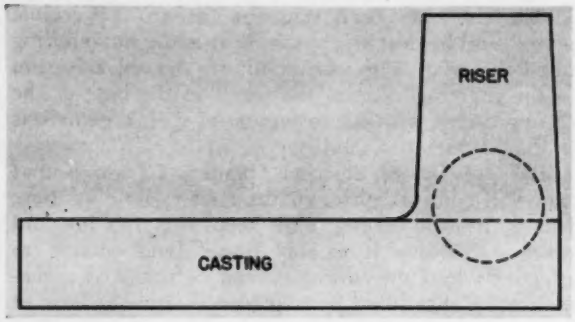


Fig. 20—Large base on riser levels steep temperature gradient, tends to result in microporosity in circle.

or other massive section that is separated from other massive sections by intervening thin walls. The question must often be decided as to whether to provide a riser for a particular massive section or whether to attempt to feed it through surrounding thinner-walled sections.

Referring to Fig. 7, it is frequently possible to feed a massive section *A* through a web *B* with the riser *R* at some distance from *A* as shown. Section *A* is chunkier than web *B* and therefore tends to cool more slowly than *B*. If *B* freezes off while *A* is still undergoing liquid shrinkage, a shrinkage defect will occur.

Overcome Cooling Tendency

The tendency for *A* to cool more slowly than *B* can often be overcome. Chills may be employed to hasten the solidification of *A*. Flow patterns can be employed which will produce flow of metal through *B* but limit flow over the mold material in contact with *A*, thereby favoring the early solidification of *A*. The following factors determine whether the massive section *A* can be fed successfully from riser *R* through web *B*:

1. The massiveness of section *A*. The more massive it is, the greater the feeding problem.
2. The thickness of web *B*. The thinner the web, the greater the feeding problem.
3. The distance from riser *R* to massive section *A*. The greater the distance, the greater the feeding problem.
4. The pouring temperature. Higher pouring temperature generally promotes better feeding of a massive section such as *A* through a thin web such as *B*.
5. The feasibility of establishing favorable flow patterns in filling the mold. Flow of metal through *B*, and avoidance of flow over the mold material in contact with *A*, favor the feeding of the latter.
6. The alloy involved. Some magnesium alloys are much more prone than others to the various shrinkage defects.

If these six factors are sufficiently favorable, the massive section *A* will be successfully fed. If not, a shrinkage defect will occur. When conditions are highly unfavorable, a shrink into the massive section will occur. If the conditions are almost, but not quite, adequate for successful feeding, the location of the defect is usually at the junction between massive section *A* and web *B*; the defect in this location may be a shirk, a draw, or microporosity.

To correct a defect of this kind, the addition of chills to the massive section is often effective. It is important to remember that the purpose of the chill is to hasten the solidification of the massive section, so that it will solidify while the web is still open. This objective has an important bearing on the positioning of the chill. Figure 19 shows a cross-section of the casting in Fig. 7. If feeding is inadequate, microporosity will occur in the general location indicated by the sketch. The porosity is concentrated at the junction of the massive section and the web, and extends out into the web itself toward the riser. There may or may not be a surface shrinkage defect in the fillet area as indicated by the arrow.

A radiograph of the whole casting will disclose prominently the portion of the microporosity in the thin wall; the porosity within the heavy section may be concealed due to the rapidly changing section thickness at this point. Any chills should be placed on the surfaces indicated by the short arrows. They should not be placed on the surface adjoining the area displaying the largest amount of porosity, as indicated by the bracket. Such chilling would aggravate the conditions causing the defect, by hastening the solidification of the web.

If chilling is not sufficient to correct the defect, the possibility should be considered of favorably adjusting one or more of the six factors listed above. The massiveness of the heavy section can sometimes be reduced by eliminating excessive machining stock. Padding between the heavy section and the nearest risered section in order to, in effect, increase the web thickness is often effective. Moving the riser closer to the massive section is technically sound, but often ruled out by design considerations. The adjustment of flow patterns to establish more favorable thermal gradients is sometimes feasible. Raising the pouring temperature often helps to reduce the incidence of defects of this type in a part having extreme section-thickness contrasts.

If no combination of the above measures is both practical and effective in correcting the defect, the possibility must be considered of applying a separate riser to the massive section. Do not expect this to be a sure-fire solution! Two massive sections which are close together but separated by a thin section create a difficult feeding problem. The thin area between the two massive sections is particularly prone to porosity or draws, which do not always respond to separate risering of the two massive sections. Frequently, the only effective solution to such a problem is the addition of metal to blend the two massive sections together.

Riser Junctions. A very important aspect of the risering of magnesium alloy castings is the design of the junction of the riser with the casting. A concentration of porosity is often found in the riser junction. Some of the best planned feeding systems, while producing nearly ideal overall thermal conditions for general soundness of the casting, fall short by inducing concentrated spots of porosity at the locations where the feeders are connected to the casting wall. An example that could be mentioned is the slot gate employing a tubular screen. This type of gate is very effective in producing the desired flow patterns, thereby introducing hot metal into top risers without excessive flow of metal through the casting cavity.

Excellent general quality can be achieved in cast-

ings using the slot gate, even when alloys having a high porosity tendency are specified. Yet, the slot gate has to be abandoned for many castings because of the presence of a band of objectionable porosity at the line of junction of the slot with the casting wall.

In alloys that have a strong tendency toward microporosity, elimination of this defect requires that a steep temperature gradient be established from the cooler portions of the casting toward the riser. Some types of riser junctions lead to a very weak thermal gradient in the general area where the riser and the casting join. Consider Fig. 20. A fixed (fastened to the pattern) riser is used to feed the horizontal panel casting shown. Solidification begins at the point farthest from the riser, and proceeds in the direction of the massive riser. Gradients are high until a point directly under the riser is reached. At this location, there is no strong tendency for the portion of the casting immediately under the riser to freeze in advance of the riser itself. Casting and riser are all part of one large mass of metal. High gradients being absent, microporosity is likely to remain in the metal that is last to freeze, which may correspond roughly to the circle sketched.

This junction can be improved by going to a loose riser as sketched in Fig. 21. This modification moves the main mass of the riser away from the casting proper. The casting has a much improved chance to freeze completely while the riser is still hot and fluid. But there is still a relatively massive section at the junction location as indicated by the circle. The mold material was preheated in this area by the flow of metal over it in the filling of the mold. Even with this improved junction, the circled area can solidify only a little in advance of the riser. With some alloys, the weakness of the gradient induces microporosity in this area. Figure 22 illustrates a usually effective solution to the problem. It is seen that the main mass of the riser is distinctly separated from the casting, and a junction is provided that becomes progressively, but gradually, heavier in the direction of the riser. This allows the casting to freeze well ahead of the riser, under a high temperature gradient.

Figure 23 illustrates ways of risering a typical casting flange; *a* and *b* frequently lead to a porosity problem at the junction; *c* illustrates a method that is usually successful.

Thermal Gradients. It has been shown that one of the basic requirements for effective feeding by risers is directional solidification. Thermal gradients must exist such that the portions of the casting farthest from the riser are coldest, with a continuous temperature rise in the direction of the riser. Even weak thermal gradients are normally sufficient to prevent visual, surface shrinkage defects. The prevention of internal microporosity, however, depends on the establishment of strong thermal gradients, particular with certain alloys. Microporosity has its inception late in the solidification process, after a considerable network of solid phase has formed. At this stage, there must be an intergranular flow of liquid through the channels remaining in the solid network, to compensate for the contraction of the remaining liquid phase. Microporosity results when this intergranular flow is inadequate.

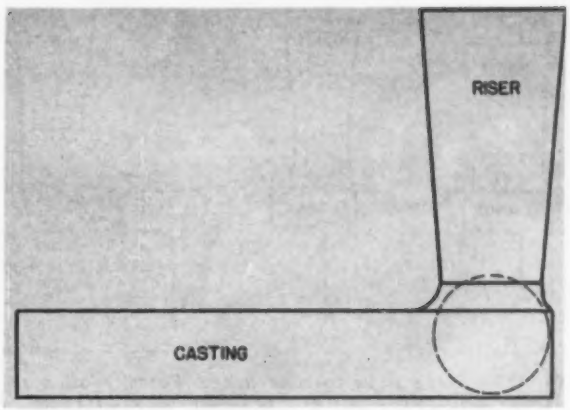


Fig. 21—Smaller riser neck (see Fig. 20) gives improved solidification pattern but hot spot still exists in area encircled in drawing.

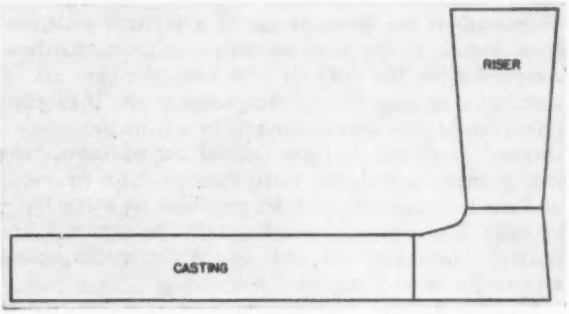


Fig. 22—Distinct separation of main mass of riser from casting allows casting to freeze well ahead of riser in approved thermal pattern.

Steep thermal gradients serve both to enhance the driving forces and reduce the resistance to such flow. Many times, therefore, the correction of microporosity depends on the ability to strengthen low thermal gradients in the affected area. An understanding of the devices and design conditions conducive to high gradients is essential to the intelligent attacking of the microporosity defect.

It is instructive to consider how thermal gradients develop in a solidifying risered casting. A good discussion of the development of thermal gradients in a risered casting is found in a paper by R. W. Ruddle.[7] Consider the simple vertical panel, risered at one end, as sketched in Fig. 2. Assume that this casting cavity can be filled in such a way that, at the moment of complete filling, the metal temperature is uniform at each point in the casting and in the riser. Make the further simplifying assumption that the mold material in contact with the casting surface is initially at the same temperature at all points. At once, heat is transferred through each portion of the casting surface to the surrounding mold material. Naturally, the temperature of the metal drops and the temperature of the mold material rises, as a consequence of this heat transfer.

Inasmuch as there is a lesser quantity of heat in the relatively thin-walled casting per unit of exposed surface than there is in the more massive riser, the casting

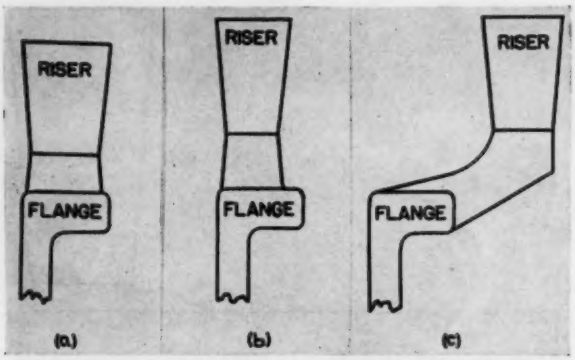


Fig. 23—Three ways to riser flange. Porosity often results with a and b; c is usually successful.

will cool faster. As the casting drops in temperature below the temperature of the riser, there is a flow of heat along the axis of the casting from the riser, tending to equalize the metal temperature at all points. The result is the development of a thermal gradient, from hottest at the riser to coolest at points farthest removed from the riser. In this way, the very act of risering a casting of uniform section sets into play powerful natural forces tending to set up the type of thermal gradients that are desired for effective feeding. A riser, in addition to its function as a reservoir of liquid feed metal, can be regarded as a reservoir of heat. The flow of heat from this reservoir is important to the establishment of the conditions necessary to the flow of liquid.

Highest thermal gradients exist when the casting is falling in temperature rapidly and the riser is falling in temperature slowly. These conditions are easiest to achieve when the casting is thin walled. The mold material surrounding a thin-walled casting has enough heat-absorbing capacity to extract the contained heat of the casting rapidly, producing a rapid drop in temperature. Further, when the wall is thin, there is a limited cross section available for axial flow of heat from the riser. Thus natural conditions tend to lead to very steep thermal gradients in a thin-walled casting.

Steep temperature gradients are less readily attained in a heavy-walled casting. The mold material in contact with a heavy casting wall soon rises in temperature to the point where it can extract heat only at a much reduced rate. In a heavy-walled casting, there is a large cross-sectional area available for axial flow of heat from the riser. Consequently, the flow of heat from the riser is sufficient to more nearly equalize the metal temperature from point to point in a heavy-walled casting.

Wall Thickness and Microporosity

It would seem, therefore, that there would be a simple relationship between the ease of avoiding microporosity and the wall thickness of the casting. It should be easy to induce steep gradients in a thin-walled part and thereby achieve maximum soundness; harder to achieve steep gradients in a heavy casting, and therefore harder to attain complete freedom from microporosity. This generalization is true within limits; a further complication arises, however, in the occurrence of some extremely thin-walled castings.

While it is true that steep gradients are rapidly established in a risered, thin-walled casting, such gradients are not established instantaneously; it takes a certain amount of time for heat flow from the riser to establish the gradients desired. The solidification of an extremely thin-walled casting may be so rapid as to allow insufficient time for the establishment of proper thermal conditions. Steep gradients are of no avail in combatting the formation of microporosity if they are not established until the casting has already passed through the critical solidification range.

An extremely thin-walled casting tends to freeze so rapidly that random thermal conditions set up by the flow patterns in the filling of the casting become important. If there has been a channel of flow over a particular portion of the mold material in the filling of a very thin-walled casting, the metal in contact with this preheated mold material tends to stay liquid a little too long, and be isolated from feed from the riser by rapid freezing of the metal in surrounding areas. Eventually, the riser's performance as a heat reservoir irons out the chance initial reversals in thermal gradient, but not always early enough in relation to the time that the casting passes through the critical freezing range.

Intermediate Thickness Best

For these reasons, it is easier to achieve steep temperature gradients *at the right time* in castings of intermediate wall thickness than it is either in very thin-walled or very heavy-walled castings. In general, microporosity is easiest to avoid in castings having an intermediate wall thickness. The author's experience would indicate the range from 5/16 in. to ¾ in. as being the easiest range to work in.

What corrective measures are in order to avoid the streaks of porosity associated with chance flow patterns in extremely thin-walled castings? The following are suggested: Use numerous risers, with junctions relatively close together. Do not expect a given riser to be able to set up proper gradients in a wide expanse of very thin wall, early enough to insure proper gradients during the critical stages of solidification. In using these numerous, closely-spaced risers, introduce the metal directly into the risers from the gating system; avoid the flow of a large quantity of metal through a particular portion of thin wall. Higher pouring temperatures tend to provide more time for the establishment of the proper gradients—soon enough to be effective.

At the other extreme of the wall-thickness range, the establishment of best thermal conditions for soundness again becomes difficult. It has been seen that the basic cause of low gradients in a heavy-walled casting is the slow rate of temperature drop of the casting, combined with a large cross section for heat flow from the riser. Fundamentally, the way to steepen gradients in a heavy-walled casting is to increase the rate of heat extraction from the casting at the time that it is cooling through the critical solidification range. The most generally applicable practical way to do this is by heavy chilling of a heavy wall, using a chill material of greater heat-absorbing capacity than the normal mold material possesses.

It is also helpful to avoid preheating of the mold material in contact with a heavy-walled casting, by avoiding excessive flow of metal over the mold material in the filling of the casting. Employment of low pouring temperatures also tends to promote a faster rate of cooling through the critical zone. Very slow pouring of a heavy-walled, vertical casting, with direct pouring of the last metal into top risers, is an effective device in promoting steeper gradients in a casting of this design.

When microporosity due to inadequate thermal gradients is encountered in a heavy-walled casting, the instinct to increase the massiveness of the risers should be resisted. Increasing the mass of the riser may aggravate the problem by delaying the solidification of the casting until the mold material has soaked up still more heat, and become less able to extract heat rapidly from the casting. Sometimes low gradients in a heavy casting can be steepened by moving the riser farther back from the area that is a problem, or by reducing the mass of the riser. The general method of attacking this problem is not to keep the riser hotter longer, but rather to cause the casting to get cooler quicker. The practical approaches to this objective are: (1) Wider spacing of risers. (2) Heavy chilling of the casting. (3) Avoidance of excessive flow of metal through the casting. (4) Slow filling of a vertical cavity, with direct pouring of the last metal into a top riser. (5) Avoidance of excessively high pouring temperatures.

Chilling. Chilling practice is so intimately related to the risering of magnesium alloy castings that a discussion of risering would be incomplete without mention of the role of chills. Chills are an extremely valuable tool in the production of high quality magnesium alloy castings. It can be said that this tool makes possible the production of many parts that would be of inferior quality without it.

The most common chill material is cast iron. Aside from its cheapness and availability, it has the advantage of being unreactive with magnesium; its magnetic property facilitates its removal from the mold material.

Chills improve the quality of a magnesium alloy casting entirely by their effect on progressive solidification and thermal gradients; they are never used merely to modify the metallographic structure of the metal by virtue of accelerating the freezing rate. They are used primarily to prevent shrinkage defects. They can do this in two ways:

1. By producing a localized hastening of the solidification rate, as, for example, when a massive boss or flange is to be fed through a thin section. Chilling of the heavy boss or flange may cause it to freeze early enough that it may be fed before the thin section has frozen off.

2. By producing a general acceleration of the freezing rate of an extensive area or portion of a casting. General chilling of a heavy section of a casting may be used to steepen thermal gradients and thereby reduce the tendency toward microporosity.

Both of these uses of chills have been discussed earlier in this paper.

Chilling Effects of Webs and Fins. A common design condition involves a thin web or fin branching out from a heavy casting wall. Such a web or fin exerts a strong, localized chilling effect on the heavy wall. Figure 25 exemplifies this design condition. Either the web *A* or the fin *B* will act as a cooling fin, providing a large surface for dissipation of heat into the mold material, and thereby exerting a localized chilling effect on the heavy section *C* at the junction location. Such a web or fin can seriously disrupt the feeding of the heavy section from the riser, by its chilling action. Visual draws are commonly observed in the heavy wall just below such cooling fins.

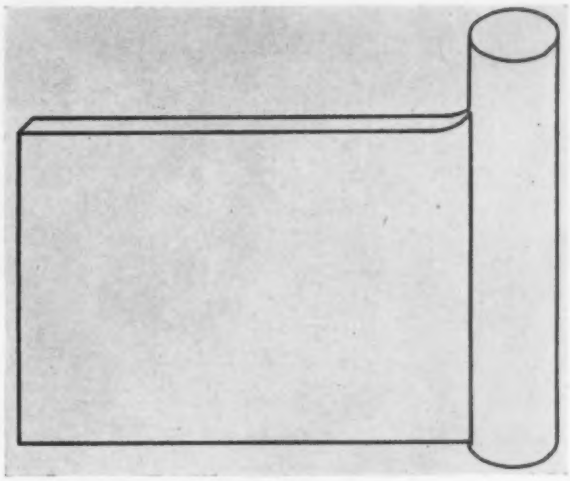


Fig. 24—Thin-walled casting with hot metal reservoir would freeze under ideal conditions if it could be filled completely with metal all at same temperature at moment of filling.

Sometimes, the natural chilling effect of a web can be used to good advantage. The risering can be so arranged as to make use of the chilling action of the web to favor desired patterns of directional solidification.

Cracking. Hot cracks are a shrinkage defect that can be troublesome with magnesium alloys. They are especially prevalent in thin-walled parts that solidify around a large internal core. The natural shrinkage of the casting after solidification is almost complete is resisted by the strength of the core. Stresses may be set up which exceed the strength of the hot casting, leading to formation of cracks.

Far more effective than gating modifications in the correction of hot cracks is relief of restraint. If a thin-walled part must be cast around a large internal core, it is desirable to make the internal core of green sand when possible. When this is not possible, special soft core sand mixes are sometimes effective. Occasionally, internal cores must be hollowed out to reduce their resistance to the natural contraction of the casting.

Coarse-grained metal has very low resistance to hot cracking. Even simple parts not subjected to unusual conditions of restraint during cooling may develop hot cracks if the grain refinement of the metal is poor.

Warpage. After the solidification of a casting is complete, it must still undergo further contraction in the process of cooling to room temperature. During this period, the overall dimensions of the casting decrease.

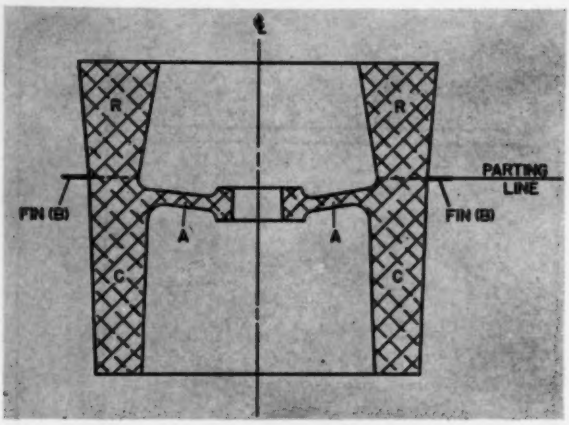


Fig. 25—Web A or fin B acts as radiator, thus extracting heat from heavier casting wall and exerting localized chilling effect.

To compensate for this, a shrinkage factor must be added to all blueprint dimensions in the construction of the pattern.

With some designs, there is a greater problem than a mere uniform decrease in all major dimensions of the casting during this cooling period. Some designs are subject to non-uniformities in the contraction of the part, leading to warpage. Figure 4 illustrates a type of casting design wherein a warpage problem is common. The casting is a circular disc-shaped part having a relatively thin wall bounded by a massive rim. To achieve best conditions of directional solidification for maximum soundness, the normal gating practice on this part would be to riser the heavy rim, gating into these risers. The innermost portions of the casting would solidify first, and solidification would progress outward to the rim, with the risers themselves freezing last.

Outer Rim Contracts

With this mode of solidification, the inner web of the casting is quite cool, and has undergone much of its shrinkage contraction, by the time the outer rim has become completely solid. In cooling to room temperature, the outer rim will naturally contract in diameter. This contraction will be resisted by the inner web which, as has been said, has already undergone most of its shrinkage contraction and has developed considerable rigidity. The effect of this lag in the cooling of the outer rim behind that of the inner web is frequently an "oil-canning" or "dishing" of the inner web; it is forced out of a flat plane into a conical shape to allow the outer rim to assume its natural diameter.

Sometimes, little can be done about this problem, other than to build the pattern in such a way as to compensate for the distortion that occurs in the casting of the part. If the outer rim is not too heavy, it is sometimes possible to correct the warpage by center risering the casting. If the outer rim can be made to freeze off in advance of the inner web, by use of chills if necessary, it may be fed from a center riser through the web; the conditions giving rise to warpage are thereby avoided. However, if the outer rim is too massive, or too far removed from the center of the casting, or if the inner web is too thin, then the rim must be risered directly to achieve soundness, and such risering is likely to delay its solidification behind that of the inner web.

Most problems of casting warpage have a similarity to the example cited above. The basic cause is generally a non-uniformity of section thickness in the design. Usually, the solidification of some heavy flange lags behind that of an adjoining thin section, resulting in a distortion of the thin wall when the heavy section attempts to shrink to its natural dimensions.

The problem can sometimes be solved by taking steps to hasten the solidification of the heavy flange, making its freeze earlier, if possible, than the adjoining thin wall. When it is necessary to riser the heavy flange, care should be taken not to aggravate the problem by employing a continuous massive riser, even heavier and slower cooling than the flange itself. Individual risers at suitable intervals are preferable. Many times the only practical solution to a warpage problem lies in the pattern construction; allowances must be made in the shape of the pattern to compensate for the expected distortion.

Acknowledgment

This paper has attempted to describe principles and techniques that have been developed and are in use at the Dow magnesium foundry. Many Dow people had a role in this development, some contributing more to the theoretical aspects, others to the practical. Among these, the author is particularly indebted to the following for their contribution to his understanding of gating and risering practice: A. T. Peters, J. G. Mezoff, M. J. Porter.

Naturally, the literature on the subject of gating and risering has also influenced the development of the theories and principles described. So many publications have discussed the various aspects of the subject that it is difficult to assign specific credit to individual papers. One exception to this general statement is W. A. Baker's paper on "Microporosity In Magnesium Alloy Castings"[8] which ranks in the author's opinion as the outstanding published work on the subject of founding magnesium alloys.

References

1. H. E. Elliott and J. G. Mezoff, "Effect of Gating Design on Metal Flow Conditions in the Casting of Magnesium Alloys," TRANSACTIONS, AFS, vol. 56, pp. 223-244 (1948).

2. R. E. Swift, J. H. Jackson, and L. W. Eastwood, "A Study of the Principles of Gating," TRANSACTIONS, AFS, vol 57, pp. 76-88 (1949).

3. K. Grube and L. W. Eastwood, "A Study of the Principles of Gating," TRANSACTIONS, AFS, vol. 58, pp. 76-107 (1950).

4. K. Grube, J. G. Kura, and J. H. Jackson, "A Study of the Principles of Gating as Applied to Sprue-Base Design," TRANSACTIONS, AFS, vol. 60, pp. 125-136 (1952).

5. W. H. Johnson, W. O. Baker, and W. S. Pellini, "Principles of Gating Design—Factors Influencing Molten Steel Flow from Finger Gating Systems," TRANSACTIONS, AFS, vol. 58, pp. 661-668 (1950).

6. H. E. Elliott and J. G. Mezoff, "A New Gating System for Magnesium Alloy Castings," AMERICAN FOUNDRYMAN, vol. 11, no. 5, May 1947, pp. 71-79.

7. R. W. Ruddle, "Correlation of Tensile Properties of Aluminum Alloy Plate Castings with Temperature Gradients During Solidification," *Journal, Institute of Metals*, vol. 77, pp. 37-59 (1950).

8. W. A. Baker, "Microporosity in Magnesium Alloy Casting," *Journal, Institute of Metals*, vol. 71, pp. 165-204 (1945).

Pre-Mixing of Reconditioning Materials for Molding Sand

BURDETTE JONES / *Sand Control Foreman, John Deere Waterloo Tractor Works*

Pre-mixing of sand additives has resulted in saving of materials, better control of sand properties, and a cleaner sand conditioning department. Written discussion of this paper, Convention Preprint No. 54-30 should be sent to American Foundrymen's Society, 616 South Michigan Avenue, Chicago 5, Illinois. The paper will be presented at a Sand Session of the AFS 58th Annual Meeting, Cleveland, May 8-14.

■ During mechanization of the John Deere Waterloo Tractor Works Foundry, the bulk of the work was set up for production on eight molding units. Each unit makes a different type, size or weight of casting ranging from a squeezer unit with a 5-lb average weight to a unit with heavy castings weighing up to 1000 lb. The materials used in reconditioning the sand were added at the muller, except for one unit having no muller where conditioners were added at the shakeout belt. Additions were bentonite, sea coal, and, generally, wood flour or a treated cellulose. The raw materials were stored in a receiving building in 50- or 100-lb bags. The bags were broken into the open top of additions tanks. The tanks had an opening in the front at the bottom, in which a shovel could be inserted, and were transported to the various molding units on platform lift trucks. Each unit would have three or more additions tanks on the sand mixer deck and possibly a full and an empty on the floor.

Guided by Hourly Samples

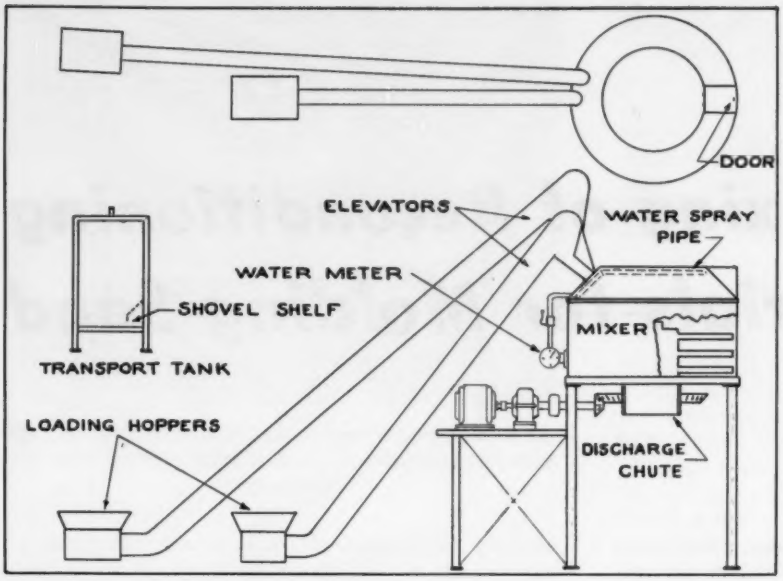
The muller operator would add, by shovel, what he considered to be the necessary amount of bentonite to each muller batch. He was guided by the posted results of the hourly samples of the unit's molding sand—moisture, permeability, and green compression strength. The amount of carbonaceous material added per batch was determined by the casting finish and also a daily loss on ignition test of the composite hourly samples of the previous day.

Due to production demands, some units were operating "under forced draft" where two minutes was the total mulling cycle for a heavy-wheel muller. This included loading, adding of rebonding materials and water, mulling, and unloading. It was necessary, in one instance, to add several shovels full of reconditioning materials per muller batch. The human element entered in and, in some cases, batches of sand did not have all of the desired ingredients added. Generally, when rushed, the seacoal or cellulose were left out; shorting of the bentonite would be easily observed by a loss in strength, carbonaceous material being harder to check. Considerable amounts of the dry materials were drawn out of the muller by the dust collecting system. Some batches of sand had streaks of material or clay balls, indicating unsatisfactory preparation.

Variations in Size

The material transportation tanks varied in size due to the different design of the units, head room of the hoists, and the desire to get more material in the tanks as the later units were built and new tanks constructed. A tank of bentonite could vary between 1300 lb and 1800 lb depending upon the size of the tank. The tanks were not interchangeable on all the units nor were they always returned to the same unit. This complicated the charging of materials used by the various molding units. This could be eliminated by using the minimum amount of material in all of the tanks, but that required more trips.

It was generally necessary for each unit to order a full tank of some of the materials before it was needed as the facing crew was not always sure which material would run out first on the sand mixer deck. There was neither room on the floor nor enough tanks available to keep a spare of each kind at the molding unit. Some batches of sand might be short one of the materials during the process of ex-



Top and side views of muller converted for pre-mixing binders and additives. Elevators and water meter simplify work of operator and make operation cleaner and safer. Inset shows transport tank used for moving pre-mix to mullers used with the various molding units.

changing an empty for a full tank and also a possible delay in delivering a full tank to the unit. To correct the difficulty, various methods of adding sand additives were considered.

The sands in the various units are cooled by being plowed across and down over "sanditioners." Five of the molding units have sanditioners consisting of five or six circular tables, alternating in diameter from 15 to 20 feet, mounted about three feet apart on a slowly revolving vetrical shaft. Shake-out sand is delivered to the top table. As the sanditioner revolves, stationary plows move the sand to the edge of the table where it drops to the next table, or to the center where it drops through openings near the shaft. In addition to the plows, rotating discs may be used to further mix the sand. Water is sprayed on the top and other tables as desired. The sand moves across one table, down to the next, back across and then down again until it reaches the bottom table where the sand is plowed off into a hopper that feeds sand to the mullers at the unit.

An increased amount of water is sprayed on these tables as the sand becomes hotter. Generally, one to three gallons of water added at the muller is sufficient to temper a bath (3000 lb) of sand. Because of the large amounts of additives, the small volume of water added to the muller, and the varying requirements of each unit it might have entailed an individual system for each muller had a slurry system been used.

Carbonaceous Destruction

Experiments were conducted in mixing the rebonding materials before adding them to the muller. The theory was that as the bond in the sand was destroyed, a proportional amount of the carbonaceous material would also be destroyed. If the proper ratio could be determined between the bond and carbonaceous material and molding conditions on the unit remain similar, it would be necessary only to keep the green strength constant to have the loss on ignition remain constant.

Seacoal and wood flour or treated cellulose were blended, with enough water to keep down the dust. Western bentonite was then added to the damp mixture. It readily distributed itself uniformly, without forming balls or becoming sticky because there was no large volume of free water available. The water was in small films on the surface or absorbed in the carbonaceous additives. There was a higher percentage of water, five to ten per cent, in the pre-mix than in tempered molding sand. The bentonite thus had a better opportunity to become saturated with water, split into smaller flakes and give much greater green strength to the sand. A special grind of the bentonite was not necessary.

Construction of Pilot Mixer

A pilot mixer was needed, so a discarded heavy-wheel muller was erected on a steel platform high enough for the muller to discharge into an additions tank. The two muller wheels were removed. Two steel plates were mounted opposite each other on the head of the center shaft. These plates were cut with a torch to make long fingers that reached to the outside shell. A short truncated cone, with a large hinged door in the flat top of the cone, was placed over the 72-in. diameter muller shell. A circle of ½-in. galvanized water pipe, having small holes directed toward the bottom of the muller was mounted inside at the top part of the cone. This pipe was connected through a valve and meter to the water line.

The two plows were left in the muller. A violent, whipping action was thought necessary so the speed was increased to about 58 rpm by substituting a different speed reducer. With increased speed, it was necessary to increase lubrication of the center shaft. A platform, with expanded-metal top, was built at working height to the door opening in the top of the mixer. This was large enough to hold two pallets (36 sacks) of bagged material and provide some working space. Fork lift trucks could place the loaded platforms of material on the raised deck.

An additions tank which held ten sacks of blended

material was selected. A table was made up of different combinations of materials with the bentonite varying from 20 to 50 per cent of the total weight. Because the wood flour and cellulose were in 50-lb sacks and the seacoal and bentonite in 100-lb sacks, there were a large number of possible combinations. A full tank was desired, so only those combinations containing nine or ten sacks were given preference. In all of the following ratios, weights, or percentages, the synthetic cellulose will be given first, the seacoal second, and the bentonite third.

Raw Material Weight Determined

Unit No. 7 was selected as the guinea pig for the experiment with pre-mix additions. This unit molds tractor transmission cases that vary in weight from 300 to 900 lb and uses the most material. Records of the previous four weeks operation of this unit were checked and used as a base period. A ratio between the requirements of cellulose, seacoal and bentonite was obtained and found to be approximately 23.3, 41.3 and 35.4 respectively, by weight. The total weight of iron poured in this period was used to determine the number of pounds of raw materials used per 100 lb of casting.

Difficulties were encountered during the first week of operation with pre-mix. Several times, it was necessary to use tanks of raw materials that were not blended. It was thought that less seacoal would be removed by the dust collector, so the starting blend was 1.5-2-3. The second day it was changed to 2-3-3 and the fourth day to 2-3-2. The average ratio by weight, including material added that was not blended, was 2.3-3-3. Bringing the total amounts to a common denominator with the iron poured for the base period, with approximately the same sand properties, a saving of about 19 per cent in the cellulose, 40 per cent seacoal and 30 per cent bentonite was realized.

Second Week's Operations

The second week had only two changes in ratio, 2-3-2.5 and 1.5-3-3. These resulted in a corrected saving over the base period of 15, 20, and 20.8 per cent. The 1.5-3-3 ratio was held for the third and fourth week resulting in a saving of 34, 34, and 23 per cent. The mix then was changed to a ratio by weight of 2-3-3 and was not changed for the next 40 weeks. The resulting saving in material used to keep similar sand properties was about 19 per cent synthetic cellulose, 32 per cent seacoal, and 21 per cent western bentonite.

The use of pre-mixed materials indicated such savings that Unit No. 1 was put on it the second week. Generally, this unit produces heavy-sectioned castings in the 100- to 260-lb. range. This unit has no muller and the blended material was added to the shakeout belt by means of a hopper in the floor and a variable-feed, vibrating feeder. Because the blend was not shoveled and must have a gravity feed through the hopper, the amount of water was kept to a minimum. This unit used a much smaller amount of synthetic cellulose and the starting mix had a ratio of 1-4.5-4. Small variations were made in the ratio due to production changes in castings, but the unit uses the same ratio, 1-4.5-4, today that it started on two years ago. Other units were put on pre-mix binders and none uses the same blend.

Changes were made in the mixer. The high platform on which the sacks of material were temporarily stored before they were put into the mixer was removed. Two grain elevators that discharged into the top of the mixer were installed on the floor. This gave much more room for storing material and eliminated the hazard of working on a small, high platform. The large loading hoppers of the grain elevators were replaced by small waist-high ones that were only slightly larger than the area of a sack of material. An expanded metal screen was fastened inside the top of the rebuilt hoppers. A sack of seacoal, for example, is placed on top of the metal screen, split open with a hook, then rolled and pulled from under the coal. In this manner, very little dust is raised. The mixer is generally left running.

Seacoal Controls Dust

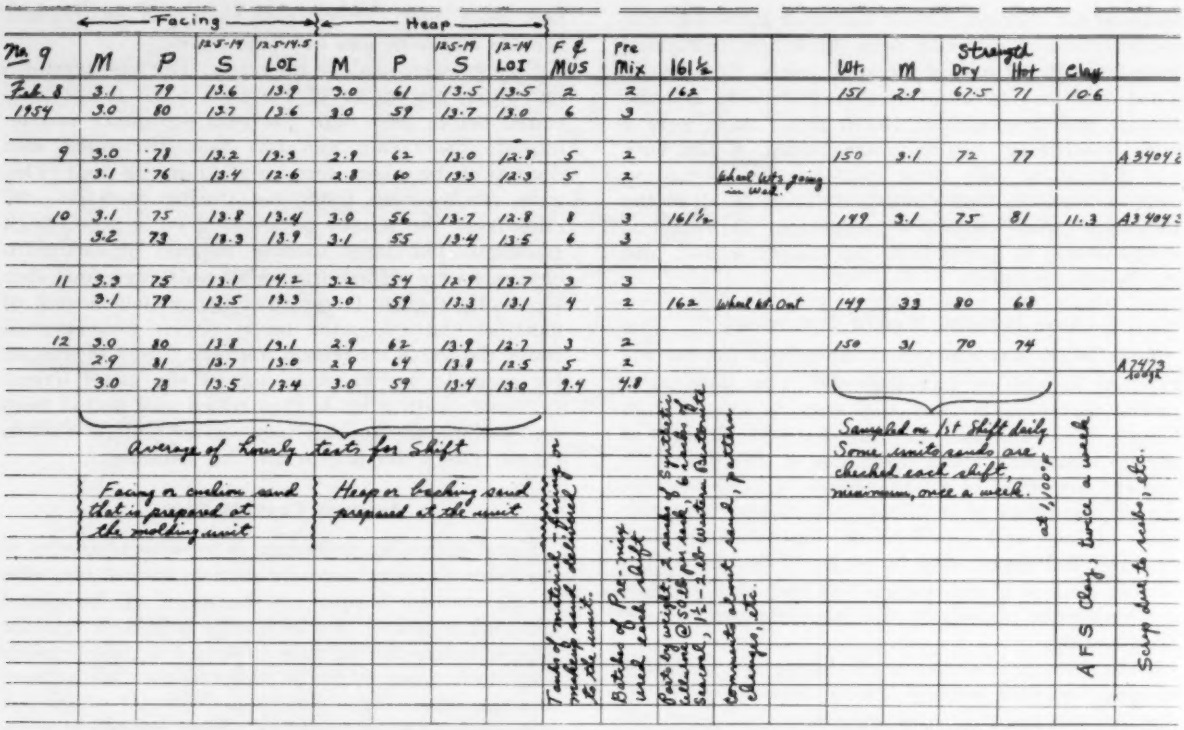
Usual operating procedure is to store platforms of the different carbonaceous materials around two sides of one elevator hopper and bentonite at the second elevator. A sack or two of seacoal is broken into the hopper before the elevator is started as this helps to keep down dust. Water is added as the coal is going into the mixer. After the proper amount of seacoal, cellulose, and water have been added, the first elevator is stopped and the materials allowed to blend for about a minute. The proper amount of bentonite is then added through the second elevator. Another minute's mixing is sufficient to thoroughly blend all of the materials. An air cylinder operates the discharge door, dumping the pre-mix into the additions tank.

A little experimenting is necessary to determine the correct amount of water for each mix. The finished blend should be free of dust, light, crumbly, but upon squeezing in the hand have a good green strength. If too much water is added, the pre-mix will not blend as easily with the molding sand and will have a tendency to bridge in the additions tank when it is being emptied. A rough guide is to add slightly more than enough water to the carbonaceous material than is necessary to keep down the dust—about five to ten per cent.

One Man Prepares Pre-Mix

The additions tanks were assigned to the units in proportion to the amount of pre-mix generally used, and the unit number was painted on four sides. Generally a full and a partly full tank are kept on the sand mixer deck and a full or empty on the floor. The facing crew knows about how long a tank will generally last and can automatically replace empties with full ones. The balance of the tanks are kept in the pre-mix mixer area. One man a shift is sufficient to prepare all of the pre-mix. He is not tied down too closely as there are spare tanks available and if he falls behind, he can catch up later without delaying the molding units.

Results indicate that savings in material alone much more than pay for the additional cost of premixing, not considering the other advantages. The pre-mix blends readily in the molding sand and no



Sample page from sand properties record book used at John Deere Tractor Works, showing data for one-week, two-shift operation of one unit. Legal-size, loose-leaf pages are used to provide ample space for notations. Notes explain use of form and also indicates information not readily identified by a number or by any of sand test data.

clay balls are formed. If the muller operator at the molding unit adds enough pre-mix to keep up the strength, there is sufficient carbonaceous material going in too so that he can't possibly short it. The muller operator has only one tank instead of two or three from which to get additions and it isn't necessary to request a specific material periodically.

There is much less dust, therefore the muller area is cleaner. Less material is lost to the dust collectors. More effective use is made of the bentonite additions. An increase of at least five points in permeability was noted when a unit started using pre-mix. A record by shifts of the number of batches of mix made is a much more accurate and easier way of determining amounts of materials used by each unit.

Control Procedure

Better control of the molding units sands is made possible by the following procedure. An operating range for each unit is determined for per cent moisture, green compression strength, and loss on ignition. A loose-leaf notebook has been made up with a separate section for each unit. The average of the hourly tests, by unit and shift, is made for moisture, the permeability and green compression strength. This is entered in columns below the previous shift's results along with the per cent loss on ignition of a composite sample of the day's run, the batches and composition of pre-mix made, and number of tanks of make-up and special facing delivered to the unit.

Sand properties seldom make any radical changes between shifts; generally it is only a gradual change such as an increase in green strength or loss of ignition. Such trends are easily noted. Corrections are made by varying the composition of the pre-mix. For example, if strength is about constant and loss on ignition is decreasing, and other things are equal, the mix can be corrected by increasing the amount of carbonaceous material per batch or by decreasing the amount of bentonite, thereby requiring more batches to keep the strength uniform. If a change in mix is desired, it can be made immediately. The sand tests are also averaged for the week and recorded in red pencil. This helps to emphasize trends.

Any decided change in the size or weight of castings made on any unit has a tendency to change the ratio of the materials destroyed and corrections have to be made.

A gallon sample of pre-mix was placed in a zero room over night. It was still loose and in condition to shovel. Possibility of spontaneous combustion in tanks of this material stored for long periods of time has been considered. No information on this is available since it is the practice to have all additions tanks empty during the inventory period. The pre-mix has been kept in storage areas for a week or more without any indication of a rise in temperature or sign of combustion.

Acknowledgments

The author wishes to acknowledge the suggestions of W. R. Jennings, foundry superintendent, the work of the Foundry Engineering Department, and the cooperation of all of the molding unit foremen. Their good teamwork was essential to the success of this operation.

Cupola Melting of Cast Iron Borings and Steel Turnings

WM. Y. BUCHANAN/*John Lang & Sons, Ltd., Johnstone, Renfrewshire, Scotland*

Experiences in melting comparatively finely divided cast iron and steel in cupolas are described in this Official Exchange Paper from the Institute of British Foundrymen. Written discussion of this paper, Convention Preprint No. 54-67, should be sent to American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, Ill. The paper will be presented at a Gray Iron Session of the AFS 58th Annual Meeting, Cleveland, May 8-14, 1954.

■ Recent examination of the history of the melting of cast iron borings, showed that a patent was granted in the United States to G. Whitney in 1872. The borings were packed in wooden boxes and these were added to the cupola charge in the ordinary way. Old sheet iron cans filled with borings were reported to have been in common use before 1900 in Pennsylvania.

In 1908, W. Y. Prince obtained a patent in the U.S.A. in which he used steel tubes about 2 ft. long and 10 in. in diameter. These were placed upright in the cupola with the remainder of the charges packed round. The tubes were filled with borings in situ, and further tubes were placed on top until the cupola was fully charged. The tubes descended with the charges as the borings melted, further tubes and borings being added at charging level as the melt proceeded. As the tubes were of steel it was assumed that the borings would be fritted and consolidated by the heat before the tube melted. This method was still used in 1916, but has obvious disadvantages and has apparently since been discontinued.

Perhaps the most important patent was that granted to A. Ronay, a Hungarian, in 1902, for the briquetting of borings under high pressures. This method is still popular although the patent has, of course, lapsed. Other investigators have studied the effect of briquetting using lower pressures with binders including sodium silicate, clay, tar, etc.

Attempts have been made from time to time to melt borings charged direct in to the cupola without previous treatment, but this has not generally been successful. It has usually been found that this leads to high losses, due to the material being blown out of the cupola, and also through direct oxidation of the borings. The large amount of iron oxide formed, produces a slag which causes severe erosion of the lining.

At present the two main methods of utilizing borings in the cupola charge are by briquetting or by enclosing in sheet iron canisters. A successful process for the melting of loose borings without previous treatment has recently been developed and this will be described later.

The foregoing is an introduction to a British Cast Iron Research Association report on "The Melting of Borings" written in 1938. The second last paragraph should be particularly kept in mind when reading this paper.

Melting Advantages

The melting of cast iron and steel borings and cuttings in the foundry has certain advantages:

1. Economy of transport out of, and new material into, the foundry.
2. Borings from one's own castings are of known composition and can be kept free from contamination.
3. The great difference in market prices between borings going out and pig coming in (assuming scrap supplies to remain constant).
4. Conservation of foundry materials, instead of a steady loss to the chemical and other industries which get these materials, such as borings, at a very low cost because of the lack of scrap policy in the metallurgical industries.

The author in this paper will give only actual data of his own work, all of which is of a distinctly practical nature, during the carrying out of which the assumption has always been that the process will work and so working conditions have been given careful consideration.

The more revolutionary ideas were always tried out by the author not out of any liking for being burned, but under the firm conviction that if workmen are interested and given reasonable conditions many a

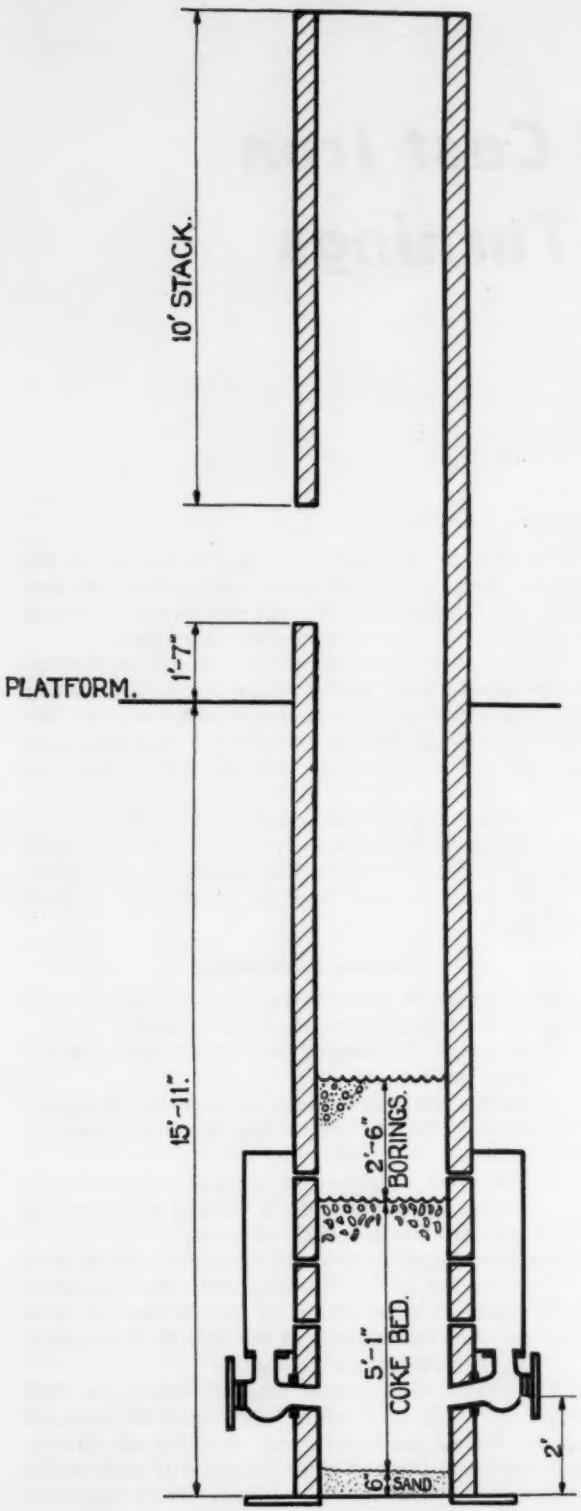


Fig. 1—Cross section of 32-in. diam., balanced blast cupola. Data for heats shown in Tables 1 and 2.

critical stage in the development of such new ideas will be successfully negotiated. It is also a good thing to have everything go wrong at the beginning. When all the primary difficulties have been overcome the workmen gain great confidence and the dismal prophets who knew all along it would not work are trapped into saying so and then silenced for good. In the last year or so, some other work has been done in England, and a little published, on the melting of loose borings in the cupola, but one suspects that this has been done with the object of proving the idea unsound.

The cupola works best with uniform materials, i.e. coke and metal of correct size which are in direct proportion to the diameter of the cupola; large material in a large cupola and small material in a small cupola but of uniform size in all cases. It is not good practice to add small material along with normally large material in a foundry cupola. The author prefers to melt small material in a separate cupola to produce pig of normal size and reasonably uniform composition for charging to the foundry cupola.

Cupola melting in a machine tool foundry is a very critical process. The machinist is inclined to dispense with the formality of metal specification, either chemical, mechanical or microscopical. The very best he gets today becomes his demand for tomorrow. Cast iron must machine easily, but wear hard, and must on machining look like steel and never on any account like cast iron. This leads to the use of low carbon, low silicon, low phosphorus irons which set quickly and must, besides being hot, be cast very quickly. If the cupola is not absolutely up to its best form, the good work of the molder and the metallurgist may be rejected summarily.

Cement Binders. About 1928 when nickel cast iron was first put forward, the author was engaged in making castings containing 2 per cent nickel and 0.5 per cent chromium. Presence of this percentage of nickel made the cuttings more valuable than usual. At that time it was the custom to use cast iron borings for making up floors throughout the engine works and stock yards. Some cupola charging material was made using cement as a binder. The material charged to a small cupolette furnace consisted of 450 lb cement briquet lumps, 400 lb nickel cast iron scrap and 400 lb common scrap.

The result was about 30 per cent loss of the briquetted material, although 90 per cent of the nickel was recovered in the resultant pig. In preparing the briquetted material, about 14 per cent cement by weight was used and the mixture was spread out in the form of a pavement, then broken up in the yard.

This operation was carried out in the open air during wet weather and this may have been the cause of excessive loss by oxidation in the cupola. This may explain why others have found it more successful since, by no doubt keeping everything under cover. Costs were worked out, and the recovery of nickel proved worthwhile, but the effect on the borings, charged in this way, led to the process being discarded.

Sheet Metal Canisters. About 1934, an attempt was made to obtain a supply of sheet metal canisters, but the supply of canisters offered was of such a price as to cause unfavorable comparison with the ruling cost of

scrap. This price turned out to be about $10 per ton of melted borings, so the idea was abandoned. Some extensive experiments were carried out using discarded biscuit tins but this also was discontinued through unfavorable circumstances of supply.

No doubt the cost quoted for canisters would have been systematically reduced by modern production methods, and a more diligent approach to the question on the part of the makers. The manufacturers contacted at the time did not appear to be very anxious to develop a new line of business, and the inquiry was frustrated by the high price quoted. A large quantity of cast iron borings was, however, packed in cans and drums and these melted in a 45-in. cupola without undue trouble as has been described by other writers.

This method seems to have been successful in one or two plants where sheet iron cuttings are available for the making of canisters on the spot. In general, the amount of borings used as a constituent of the charge when added in this manner, is similar to that employed using briquets. The average addition in the cases available is 10 per cent with, in special circumstances 15 to 20 per cent.

Cement Bonded Steel Cuttings. Several mixtures were tried using cement, coke dust, and small cold saw cuttings. The overall diameter of these cuttings was about ¼ in. Briquets were made in 9-in. cubes in a machine specially designed for the purpose and operated manually. The setting time, of course, was entirely dependent on the characteristics of the cement. The machine, apart from shaping the block, did nothing else and the resultant hardness was due entirely to the cement. The pressure which would be required to improve the bonding would be not less than 300 tons.

The operation of this machine was too slow; for any degree of success a continuous operating plant would be necessary. High expense ruled this out.

A return was then made to laying the material out like a pavement using the mixture:

6 buckets steel cuttings
2 buckets sand
½ bucket coke breeze less than ¼ in.
1 bucket Portland cement.

This was mixed in a concrete mixer. Hardening time was at least seven days. When broken up the mixture left considerable quantity of rubble, especially when the turnings were not small enough.

This material showed no signs of serious rusting and in the cupola appeared to melt quite satisfactorily. The practice was eventually discontinued as the material was difficult to hand charge, there was the excessive amount of rubble, and labor costs were high. These objections could have been largely removed by suitable mechanization.

Continuous Melting in a Crucible. A temporary pit fire was constructed over a chimney flue, and into this was incorporated a 600-lb graphite crucible with a ½-in. hole drilled through the bottom. This was charged with dry cast iron borings and as the melting proceeded the cast iron ran straight through into the ash pit, where it formed into small pigs, which were periodically removed. The idea was to impart to the borings only the minimum heat required for melting.

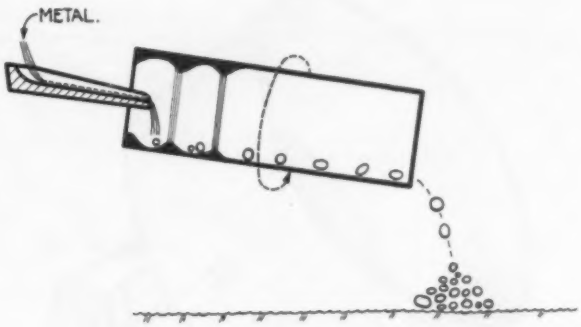


Fig. 2.—Tubular casting machine designed to produce lumps of metal from melting borings for remelt.

As the molten metal ran out it made room for cold material moving downwards. The melting rate of this experimental arrangement was only 20 lb per hour and the weight of the coke consumed was equal to the metal melted.

No doubt the efficiency of this method could have been greatly improved and the coke consumption reduced to about 30 per cent or less in a standard tilting crucible furnace. The project was abandoned because of the low capacity and because experiments were about to commence in a 32-in. cupola.

32-in. Balanced Blast Cupola. All previous methods of preparing borings, such as pressure briquetting, packing in containers, bonding with cement, clay, tar, sodium silicate, etc., are applicable only to cast iron borings and steel turnings in the smallest form. Some of the methods apply only to cast iron borings. Such material as cleaning-room refuse, and sand-plant tailings containing fins, sprigs, gaggers, and small metal pellets is unsuitable for briquetting or packing in containers.

Similarly, the cupola drop contains a large quantity of dispersed metal bonded to coke and slag. In normal cupola practice the slag should be kept in good condition, enabling the iron to be collected by electromagnet, and charged to the borings furnace without preparation.

"Attempts have been made from time to time to melt borings charged direct to the cupola without previous treatment, but this has not generally been successful. It has usually been found that this leads to high losses due to the material being blown out of the cupola and also through direct oxidation. The large amount of iron oxide formed produces a slag which causes severe erosion of the lining." This quotation from the B.C.I.R.A. report clearly shows the prejudice against loose borings. Indeed, of about 100 foundrymen who formed an organized party to the author's foundry in 1936 to inspect the melting of loose borings in the cupola, it is certain that not one believed even what he saw.

This process as now carried out seems simple but at the time of commencing these experiments early in 1936, it was generally considered so impossible as to bring ridicule on anyone who suggested otherwise. Naturally oxidation, lining loss, and loss by ejection were constantly in mind during the planning of all early experiments but some of the precautions taken

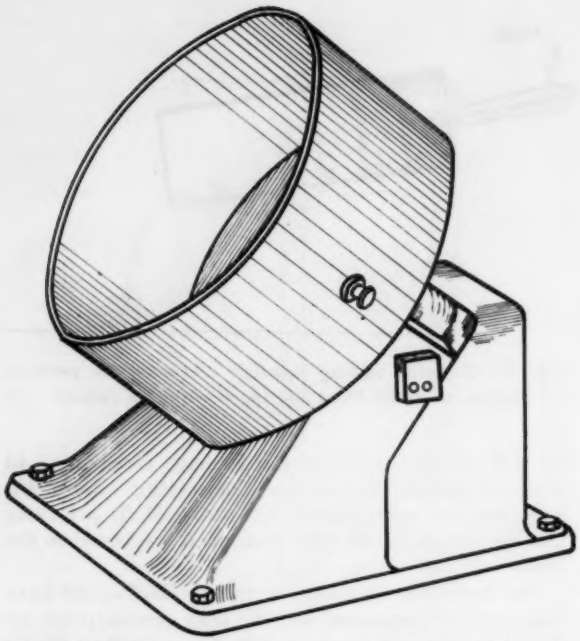


Fig. 3—Rotating bowl used to mix molten iron with steel Cuttings to produce readily charged lumps.

have now proved unnecessary in the light of present knowledge and experience.

In 1936, the rather sudden market change and the marked scarcity of raw material of any kind during the early stages of preparation for the second world war, revived the question of using borings. While waiting for a more orthodox melting unit the author began trying to melt borings and steel turnings in a 32-in. cupola which was then not in use and it therefore did not matter whether the lining was lost in the first heat or not as far as foundry production was concerned.

The first trial was made with very little blast, the blast gate being closed down at the fan, and the tuyeres at their normal setting. The charges consisted of 100 lb of borings mixed with 50 lb of 3-in. coke. Melting was very slow, the metal hard, and so pasty that it had to be drawn out of the back door until it finally froze up.

When the bottom was dropped, large masses of partly fused borings remained in the furnace. The lump was too big to come through the bottom doorway so the sand bed was replaced and coke packed under the lump, ignited by kerosene burner and the blast put on extremely gently. Periodically the blast was put off and small coke pushed into the furnace through the tuyeres. By keeping the tap hole open, metal was slowly drained off. When a small clearance was melted off the outside of this lump, coke began to feed down from above and the process gathered momentum. In this way the large lump was completely melted out without damage to the lining, leaving the furnace ready for the next heat.

Second Attempt. With a view to reducing oxidation, the main tuyeres were reduced by ramming in 1¼-in. bore tubes. It was thought that this melting problem would have to be dealt with much in the same way as smelting ore, i.e., to work the cupola like a blast furnace and have a reducing atmosphere in the upper zone. Coal was added as part of the fuel charge.

The blast did not pass through the charges well owing to the stock line being too high. The slag attacked the lining severely and caused much trouble. Only about 5300 lb of 6600 lb of metal was melted owing to a breakout and the furnace being dropped while still full of material.

This was a right mess.

Third Attempt. The third trial was very successful. The coke bed was 3 ft deep. The charge consisted of 200 lb cast iron borings, 200 lb high silicon pig iron, 75 lb coke, 25 lb coal lumps, and 75 lb broken limestone. The 2800 lb of metal charged was apparently all recovered. (This 100 per cent as explained by the furnace operator was due to melting away the main and auxiliary tuyeres.) The melted metal had the following composition: 2.44 per cent C, 1.63 per cent Si, 0.50 per cent Mn, 0.097 per cent S, 0.44 per cent P. The cupola was tapped continuously and the metal and slag ran well. It was apparent that the melting rate would be about one ton of borings per hour. However the lining loss was very heavy.

The next five or six trials (which aimed at a greater proportion of borings) were more or less a series of accidents. Owing to a large number of mishaps with the small, continuous tap hole, which alternately broke out, froze up, or put the slag into the main tuyeres, it was decided to discontinue this and return to botting and tapping. One of the main causes of trouble was the damping effect of the fine material and it was subsequently found best to put on two charges of scrap to get the furnace properly started and prevent metal from solidifying on the bottom and causing frozen tap holes.

The resistance of the charges was evidently the determining factor on the rate of melting and it was possible to literally put the furnace out altogether by putting on too many charges. The practice finally standardized was to start with two charges of 500 lb scrap and charge at the same rate as the liquid metal was tapped, keeping the flame coming through freely.

Coal Discontinued

The coal, coke, scrap borings and limestone were mixed before charging and that evidently helped to keep the stock from bridging and choking. Coal was eventually discontinued after the 11th melt as it was found possible to melt with very little oxidation with the normal setting of the balanced blast tuyeres.

The lining had to be entirely renewed in the lower section of the furnace after the seventh heat, after giving much trouble through wearing thin at unexpected places and having to be cooled with water, etc. It had to be re-lined again for the 13th heat because as much as 50 per cent fine steel turnings was used with the borings to keep the charge open and promote free ascent of the gases in the furnace. This addition of steel gave rather cold, pasty metal which formed skulls very badly in the ladles and so additions of bone meal and sand were made to the charges to promote fluidity by raising the phosphorus. As the steel was eventually discontinued, the bone meal was also discontinued.

As the melting temperature was gradually improved, the quantity of borings in the charge was increased to:

TABLE 1—HEAT NO. 23 IN 32-IN. BALANCED BLAST CUPOLA

	Metal						Slag					
Time	Temp, C	C	Si	S	P	Mn	SiO_2	Al_2O_3 + Fe_2O_3	MnO	CaO	Fe	S
9.15	Blast on											
9.45	1340	3.09	1.79	.136	.79	.39						
9.50	1360	3.08	1.79	.143	.62	.40						
10.05	1380	2.92	1.37	.178	.62	.43	53.24	23.42	2.62	24.05	7.60	.358
10.20	1380	2.85	1.12	.182	.60	.40						
10.30							53.39	25.52	2.81	21.32	11.41	
10.40	1390	2.77	0.79	.16	.60	.30						
10.45							45.21	32.61	2.58	15.59	18.00	
10.55	1390	2.89	0.78	.17	.65	.27						
11.05							50.00	35.61	2.74	15.11	16.50	.006
11.15	1390	2.52	0.69	.16	.59	.25	52.18	26.89	2.43	17.54	7.60	
11.25	1390	2.66	0.89	.15	.60	.29						
11.30							44.24	44.4	1.24	12.00	21.80	
11.40	1390	2.56	0.66	.16	.61	.21						
11.45							43.10	36.62	1.87	16.06	17.75	.184
12.00	1390	2.52	0.72	.15	.70	.25						
12.05	1390	2.28	0.78	.13	.75	.22	44.62	31.28	2.89	15.04	13.95	
12.20	1370	2.19	0.75	.14	.65	.18	48.97	30.26	2.06	16.14	13.20	
12.25							44.02	36.49	1.71	13.75	18.00	
12.35	1370	2.43	0.74	.15	.66	.17						
12.40							47.18	37.98	2.45	10.59	17.50	
12.55	1370	2.45	0.63	.16	.56	.17						
1.00	1370	2.56	0.89	.14	.57	.23	52.43	25.85	2.93	15.00	7.10	
1.05												
1.10	1370	2.34	0.89	.14	.61	.23						
1.15							50.39	26.44	2.85	17.30	7.60	
1.25	1370	2.38	1.17	.13	.58	.12	48.77	28.64	2.70	16.28	12.68	
1.55		2.24	0.79	.15	.61	.19	46.78	29.02	2.51	20.16	10.40	
2.00		2.45	0.98	.16	.65	.20	50.66	28.99	3.28	19.97	11.41	.106
2.05	1370	2.27	0.64	.16	.66	.21						
2.15	1370	2.34	0.65	.16	.66	.27						
2.30	1370	2.24	0.78	.15	.65	.32						
2.35	Blast off											

400 lb borings, 200 lb pig or scrap, 100 lb coke (no coal), 75 lb limestone, and 50 lb sand (oil sand cores).

Wear on the lining soon became the only serious problem and after careful consideration this was thought to be due to: (1) The quantity of fine steel cuttings; (2) The accidental irregularity of blast distribution; (3) The slag composition. First the steel was discontinued. Care was taken to keep all tuyeres to correct shape and to keep them clear during melting as in the normal working of the balanced blast cupola.

Oxidation seemed to be more pronounced at the end of the blow. This was thought to be due to more rapid blowing on the relatively empty cupola, so a charge of scrap was put on at the end to restrict this tendency. Later this was replaced by a charge consisting of small coke, slag, and small metal and sand from the cupola drop of the previous blow. This seemed to have a beneficial tendency on the lining and the necessary damping effect on the blast.

Heat No. 23 may be taken as an example; Table 1 shows numerous details of the heat. Other information includes: patching—40 bricks (1½ in.) and 500 lb ganister; metal—two charges of 500 lb scrap, 20 of 400 lb borings (practically all cast iron) and 200 lb alternately pig or scrap, final charge, 500 lb scrap; other charge materials—100 lb special coke, 75 lb limestone, and 50 lb sand.

Total material charged was 13,500 lb; loss was determined by collecting and weighing all the melted metal. This gave a figure of 6.85 per cent. However the weight of slag per ton of metal melted was found to be 440 lb or 22 per cent. Since the average iron content of the slags in Heat 23 is 13.3 per cent, this would represent a loss of iron to the slag, by oxidation, of 2.93 per cent and this figure should compare favorably with most cupola practice.

Variations in Costing Systems

Systems of costing vary so much from one foundry to another and more so from one country to another, so this aspect would have to be considered on the spot. Wages, cost, and quality of materials all would have to be considered. Scrap may cost twice as much as borings according to the official control price in Britain, but there is no doubt that the actual price of scrap is much higher. By a little adjustment of paper values a project of this kind can be voted uneconomical at any time. However this discussion is concerned solely with whether or not the process is possible from a practical point of view.

The first metal was used for flask parts, etc., which adds to the economy of the process. There should be little difficulty in altering the composition of the final product within a fairly wide range. For instance, gray iron from a charge of 400 lb borings and 200 lb pig gave the following analysis: TC, 2.72 per cent; GrC, 1.45; CC, 0.77; Si, 1.45; S, 0.112; and Mn, 0.35. Test of this metal treated with two silicon briquets

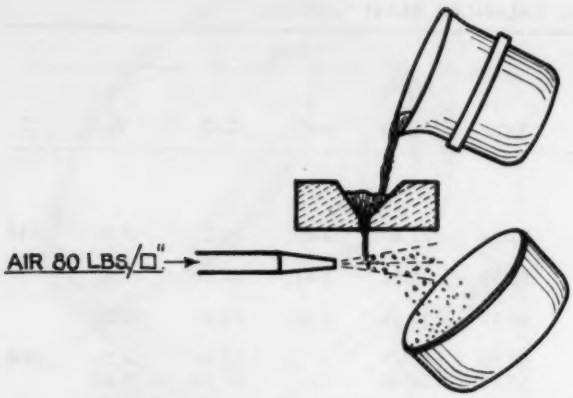


Fig. 4—Sampling device provides small shot which gives superior uniformity of results in carbon determination.

gave a transverse test about 25 per cent above the Grade A specification.

The sulphur tends to run higher than might in some cases be desirable but this can be regulated by soda ash treatment in the ladle. It is probable that the addition of silica sand to the slag may restrict the maximum sulphur elimination by way of the slag, but this addition was necessary to reduce lining wear.

The melting rate for this furnace is about 1¼ tons of borings per hour or about one third the rate of the cupola on normal melting. The coke consumption was about 25 per cent total (includes bed) and 16 per cent coke splits. The limestone is preferred in ½-in. size free from fines. This mixes and fuses easily and is easily stored and measured out. The lining wear was greatly reduced until the best run was 672 heats, without relining the lower section.

Table 2 shows the quantity and proportions of material melted in four consecutive months. The columns showing scrap and pig iron can be discounted as being necessary in the mixing of the charge of borings, but these could have been charged direct to the foundry cupola as far as their size was concerned. After about 20 heats the process settled down to routine and was carried on for years without any supervision other than the normal recording of weights of materials involved, times of operation, and routine analysis. The consumption of cast iron borings reached 100 tons which in turn absorbed a further 30 tons of steel cuttings per month.

45-in. Cupola Experiments. To augment information gained from the early experiments on the 32-in. balanced blast cupola, it was decided to allow the 45-in.

TABLE 2—TYPICAL MATERIAL CHARGED IN 32-IN. BALANCED BLAST CUPOLA

	Pounds Metal			
1939	Scrap	Cast Iron Borings	Pig Iron	Refuse*
August	28,300	45,900	. . .	17,500
September	17,000	74,400	16,800	25,000
October	23,000	110,400	28,800	24,700
November	28,500	128,000	34,500	42,100

*Salvage from sand plant, cupola drop, and cleaning room.

cupola to blow down after the day's cast and re-start melting borings. The intention was to observe the effect of rate of melting on cost, i.e., wages, patching, coke consumption, etc.

The effect of melting in the 45-in. furnace after the normal run was to reduce coke consumption and wages by half. Patching remained the same per ton while the total loss of iron was 8.8 lb per ton or 0.4 per cent. Charge used consisted of: 900 lb borings, 600 lb 4 per cent silicon pig, 200 lb coke, 100 lb limestone, 50 lb sand, and 8 lb soda ash. From this it seems that the rate of melting would be about one third of the rated capacity of the cupola.

As this furnace was charged after being blown down, the heat was very troublesome. After a few seconds exposure, the operators' clothing began to smoke although it did not catch fire. Thus the charge had to be literally thrown at the furnace without a backward glance. As a regular process, mechanical charging would be necessary and the handling of hot metal in the foundry would have to be organized particularly with a view to working conditions, at the casting point.

Ferrosilicon Process. In 1943, a press notice appeared of a process in which one cupola was virtually set on top of another. The inventor claimed that steel cuttings and sand (SiO_2) in the top cupola, would pass through a reducing stage in which the silica would be converted to silicon. This would melt the lower cupola and be absorbed in the liquid steel drops, thus producing ferrosilicon.

To try this out, a temporary shell and wind belt were constructed on top of an 18-in. cupola so as to make a continuous shaft twice the normal height. The bed height was taken above the top tuyeres and after lighting up, charges of silica sand and steel turnings were put into the top cupola. There was some difficulty in balancing the pressure of the fans and the final result was that the gases from the lower fan took a short cut through the top fan and burned out the motor. This happened so quickly, of course, that the situation got out of hand and it is still uncertain whether one large fan situated so as to blow in air at both levels, would have been any more successful.

Notwithstanding this, the opinion was formed that silica would not be reduced in an apparatus of this size, and that it is likely that the furnace would have to be of such a height that the passage of the charges from the charging door to the melting zone would occupy about 24 hours. This of course is similar to the standard blast furnace. This project was therefore abandoned.

The melting of borings in the 32-in. balanced blast cupola was stopped for a number of reasons in August 1948 after 11½ years continuous operation. Since the melting of borings had to be carried out in the evenings to avoid interfering with the normal melting for castings on the same cupola platform, elaborate blackout precautions had to be observed when the bombers were coming over. As there was considerable glare from the almost empty cupola and this was easiest seen from above, a contraption like a Chinese pagoda has to be constructed over the dry spark arrester. This kept burning down or blowing away in the wind. The housing of the cupola platform had to be sealed up even to the smallest openings such as ¼-in. diame-

ter bolt holes, so that natural ventilation was almost impossible and the conditions at the charging door became very trying.

Another discouraging reason was that under the wartime pig and scrap allocation schemes, borings were taken into account so that others got allocations of good scrap which we were not allowed because we were melting borings. Finally, during the latter part of the war and in the years immediately after, the poor quality of the directed labor put us off the notion altogether, and we decided to cease operations for the time being.

Casting Metal. Casting and handling of hot metal became more of a problem as the tonnage increased. Cast iron pig molds of a simple design were set out in a long row. These were filled in turn, then picked up by the crane, and the solidified pig deposited in a skip at the end of the line. The number of molds required was determined by the necessary cooling interval between each refill. If the refill was too frequent, the pigs began to burn on. This method required considerable crane handling. No doubt mechanization could be introduced here, but as it was carried out, the work was very hot and fatiguing to the operators.

An alternative method was to set up a small pig bed outside, and make the pig troughs in the shape of a large gate, that is, troughs were cut in the form of a square and then various diagonals, etc., run across. This was quickly hooked up by a jib crane and swung out of the way to cool. The bed was roughly smoothed out again with a shovel, and the next ladle cast. The objection to this method was that the "gates" were very thick at times and the iron very strong and usually had to be broken with a ball, dropped from a great height.

Another method tried was the making of drag molds on a squeezing machine. These could be made very quickly and set down as required. The objection here was that soon a large quantity of extremely hot sand was obtained which was very difficult to deal with.

Tubular Casting Machine. A large horizontal cast iron tube about 20-in. in diameter and 8 ft. long was constructed to rotate on its horizontal axis. The idea was to pour metal into one end (slightly higher than the other) so that with the tube rolling the metal would form into lumps during the plastic stage. The metal was to run from the continuous runner of the cupola through this tube to deliver roughly spherical lumps at the other end. This experiment was not quite successful as it was difficult to prevent the formation of a pipe casting similar to those made in the spun pipe casting process. The speed of rotation is apparently critical, as is also the initial temperature and composition of the metal, and of course the cooling rate of metal while in the tube. Steel turnings were introduced into the runner before the metal entered the tube and this showed signs of being successful but the confined conditions of the experiment and the rising temperature of everything including the author stopped the trials.

This scheme would work with proper design and reasonably remote control. It appears that the diameter of the rotating tube would need to be 36-in. or more. Perhaps the slope of the tube is also critical even to the extent of providing for adjustment of the angle of slope during operation.

Steel Cuttings. Since the main problem was the absorption of large quantities of heat from liquid cast iron, efforts were made to stir steel cuttings into the metal in the ladle before casting. Cuttings were also put in the chill molds before pouring, but these tended to float, and if the chill was damp the metal flew badly.

Experiments with pouring metal into a large mass of wet turnings, for example, in a 2-gal. bucket, showed that the iron percolated through the cuttings to a considerable depth before freezing. The resulting lump had absorbed 45 per cent of the steel cuttings and solidified almost instantly; it was rather rough to handle manually.

Wet cuttings were no trouble, since the porous mass allowed steam to escape readily. To develop this idea further, a rotating bowl was designed (Fig. 3). It was set at an angle of 35°. During rotation, the steel cuttings climbed up one side from 6 o'clock to, say, 10 o'clock, then rolled continuously down the slope.

The liquid metal was poured at about 7 o'clock and the balls, formed by the freezing of cast iron round the steel particles, were continuously covered by fresh cuttings. If this process was continued, these balls collected more cast iron, rolled to the front, and fell out, thus giving a continuous casting system, whereby liquid iron absorbed a further 30 per cent of steel and gave a product quite suitable for ordinary cupola charges. This machine worked for 7½ years.

Size Important

The cold material used in this process can be very small but not so small as to be pyrophoric. In one experiment carried out by request, bags of fine material were thrown into the bowl and the hot metal poured. There was instant combustion and very dense iron oxide smoke. The pouring was being done from a temporary wooden platform 10 ft high from which it was inadvisable to jump because of the low visibility. Such an experience enhances one's admiration for Joan of Arc. It developed later that this material was in the habit of catching fire in contact with a lighted cigarette.

Steel cuttings or turnings vary considerably in size, and are often in long spirals of varying diameter. These have considerable bulk, and are very light and often extremely difficult to handle. When dumped in a heap they become so interlocked that they cannot be separated neatly.

A chopping machine was designed and made on the principle of the cane shredders used in the sugar estates. This type of machine should be operated by the machine shop, because bushy turnings are better dealt with at the source. For this reason the design and construction need not be given here. The upkeep of the machine was relatively low and it maintained a sufficient supply of steel cuttings of convenient and uniform size, to keep the casting process in operation.

Microscopic examination showed that during the balling process the steel cuttings were surface-carburized, and this led to the supposition that the melting point of the steel would be reduced. This point seems to be either disbelieved or not appreciated by the steel makers.

Experiments with a small crucible containing cast iron-coated steel turnings made by this process, showed that softening and settling began at 1000 C to 1050 C

Fig. 5—Travelling yard crane used to charge borings melting cupola made outside operation possible.

and complete settling to minimum volume took place at 1260 C, notwithstanding the fact that the melting point of the steel was 1450-1500 C. This material melts well in the standard cupola and, as the steel is coated, the sulphur pick-up in the cupola is less. It was used as 45 per cent of the cupola charge. It should form a useful charging material for large open hearth steel furnaces where a reduction of charging time would facilitate increased output per shift.

Other materials can be incorporated in the cast iron lumps, such as ferroalloys and solid carbon. Adding carbon in the form of ¼-⅛-in. particles produces a lump material containing 20 per cent carbon plus the natural total carbon in the iron. This may be a convenient method of introducing alloys to charges or high carbon material to steel furnace charges as in open hearth practice.

Carbon Added to Iron-Steel Lump

For cupola charges, a lump material composed of cast iron and carbon may not produce a spectacular carbon increase, but the results would be more positive when carbon is added to a cast iron lump containing 30 per cent steel.

During these experiments the rotating, open-ended cylinder (Fig. 3) was unintentionally over-charged with liquid metal, so that a substantial quantity of metal was rolling fluidly in the vessel. The cooling water spray was turned on and the liquid cast iron cooled to the pasty stage when it instantly turned into small shot like sand.

This very small shot, which is usually less than 70 mesh, might have several industrial applications and seemed an excellent material for uniform and representative sampling of cast iron, particularly white iron. A smaller scale mixer was considered as a method of sampling and various designs were considered, tried, and rejected in favor of a jet of compressed air to disperse the liquid iron into small pellets which are caught in a copper pan.

Then a method for steel sampling appeared in the American press, consisting of a glass tube pushed under the surface of the liquid steel. By releasing a compressed bulb at the top of this tube, a column of steel rose several inches in the tube and solidified as a clean solid steel wire which could be sheared into suitable pieces for analysis. This method would not work on cast iron because of the long freezing range. The suction drew the liquid from the center of the column and produced a ragged thin tube with some of the metal often up the operator's sleeve. The tube so produced would neither cut nor break conveniently.

Fireclay Funnel Used

The method standardized uses a small fireclay funnel with a ⅛-in. diamater orifice. The metal is blown into a copper vessel about 15-in. in diamater containing a little water and wet surfaces (Fig. 4). This gives a sample instantly ready for use. The sample is much more representative than any form of drillings. The well known errors of the carbon estimation due to the pulverizing of the graphite during drilling and concentration in the fines of the sample are eliminated.

In the manufacture of machine tools, the key to quality of cast iron is in the control of carbon, i.e., the quantity, particularly the quantity of free graphite, together with the size and formation of the flakes. Repeated analysis on the same sample of pig iron got by drilling resulted in the following for per cent total carbon: 3.43, 3.41, 3.37, 3.49, 3.45, and 3.40, with an average of 3.42. There are no reliable "standard cast irons" on the market and suppliers have always turned a deaf ear to requests for carbon standards. It is therefore a difficult and tedious process for a foundry metallurgist to check his apparatus at any time and much unsatisfactory duplication goes on.

The unreliability of the results is due to the fact that while boring a sample the graphite is pulverized and may be lost to a varying degree in the sampling and again at the weighing out stage. When the above sample is graded on sieves, the variation in results is considerable, as shown below:

Remaining on	22 mesh	3.54%	Total	Carbon
" "	44 mesh	3.40%	"	"
" "	72 mesh	3.27%	"	"
" "	100 mesh	2.88%	"	"
Through	100 mesh	3.99%	"	"
Average		3.42%		

It is thus impossible to lift a small quantity which will be so blended as to give a representative average composition. Segregation of carbon was clearly demonstrated many years ago and elaborate patterns of hole boring have been used to get a representative sample from even a sand cast pig.

The pellet method is the obvious answer to these problems since it can be applied to liquid metal in the foundry. Its advantages are that it is ready almost instantly for use, instead of boring the sample the next day and of course all further preparation is unnecessary. There appears to be no oxidation of cast iron whatever during granulation, and there is no need for special inert gas atmosphere as may be desired in the case of sampling mild steel.

Repeat analyses carried out on a drilled sample of cast iron gave the following succesive percentage of total carbon: 3.00, 3.01, 3.07, 3.10, and 3.16, giving an average of 3.07. The same metal sampled in the form of pellets gave 3.19, 3.19, and 3.19. Thus, the drilling

method is shown to give low results and the difference in successive tests is due to the fact that the larger chips of cast iron are inclined to be lifted first. As the sample is used, the proportion of fines increases and the percentage of carbon increases.

When iron is run from the furnace white or near white, it is impossible to bore. The casting of very heavy samples even up to 7-in. square sections does not make for any improvement. This is when the pellet method becomes indispensable.

24-in. Borings Cupola. In January 1952, when a large travelling crane became available in the foundry yard, it was decided to set up a separate melting station with a convenient pig bed served by a monorail loop on which the metal could be conveyed from the continuous runner to the points of casting. Two ladles are worked alternately, one filling while the other is casting. A 24-in. cupola was used. Height from the center of the tuyeres to the charging platform was 4 ft 6 in. and the charging door 15 in. above the platform. The coke bed level was 3 ft 6 in. above the tuyeres. Blower used was a standard cupola fan rated to give one ton per hour on a furnace of this size, melting for the production of castings. The furnace was fitted with a wet spark arrester consisting of a flat mild steel cone on to which was directed from above a supply of 2000 gal per hour of water. From the condition of the surrounding roof this appeared to work at almost 100 per cent efficiency.

The charge consists of 379 lb borings or other small material, 56 lb 3-in. coke, and 8 lb limestone (½-in. graded). These were mixed on the platform and shovelled into the furnace to maintain a height above the bed level of 18 in. to 2 ft. The furnace was intentionally made short and the charging door placed so that it was impossible to overload the furnace seriously. At the same time there was no difficulty in observing the behavior of the charge. In a year's run, during which many alterations and unusual experiments were tried, the following figures were obtained:

Average melting rate	1525 lb per hr
Average length of blow	7¼ hr
Rated capacity of blower	1 ton per hr
Average fuel consumption	400 lb per ton of metal
Average patching material	150 lb wet ganister and 9 firebricks per ton of metal

A butterfly control valve was introduced for the regulation of the blast and numerous attempts made to improve melting conditions by manipulating this with varying and uncertain degrees of success. The water discharged from the spark arrester into a trough with an overflow. This trench retained all the material coming from the spark arrester and it was found to work out at only 0.7 per cent of the iron charged. However the actual iron content of this deposited material was 67 per cent. This makes the iron lost up the stack 0.46 per cent of iron charged.

Excessive loss up the stack is the most usual argument against melting loose borings in the cupola. That this argument is not justified is shown by typical figures for an all-borings heat. A total of 10,000 lb was charged, 500 lb being small scrap to start the

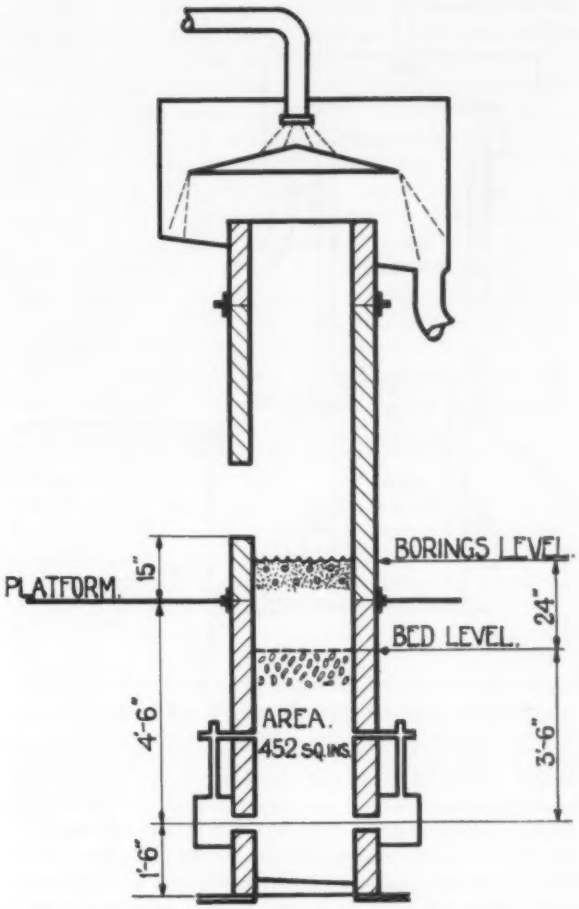


Fig. 6—Cupola lined to 24 in. was purposely made short to make overloading with borings impossible. Furnace worked well for a year, averaging 7¼-hr. heats and ratio of 5 lb metal to 1 lb coke. This furnace was replaced with 32-in. cupola (Fig. 7).

heat. Pig produced weighed 9900 lb. Loss was thus 100 lb or 1.06 per cent of borings lost from all causes. From this and similar experiments it seems that most, if not all, of the iron loss to the slag was oxide before entering the cupola and that with perfectly clean metal, no matter how small, the loss by oxidation would be practically nil. Similarly, rusted cast iron borings in a small quantity are not much trouble. This should be so, because the silicon, manganese, and carbon content of the cast iron would effectively protect the iron from oxidation. The loss by oxidation would be higher for steel cuttings if these are not chopped down to high bulk density for charging.

It was soon evident that the whole process was on too small a scale but it was found to be an excellent training ground for foundry labor, furnacemen in particular. Since the constant aim was to produce a hard, close-grained or even white iron, very little latitude was allowed for delays in pouring.

The furnaceman could not move inside the furnace and so patching was difficult and often improperly done. The air blast in the melting zone was too concentrated and when channelling took place this caused slag particles to be thrown up the stack so that they

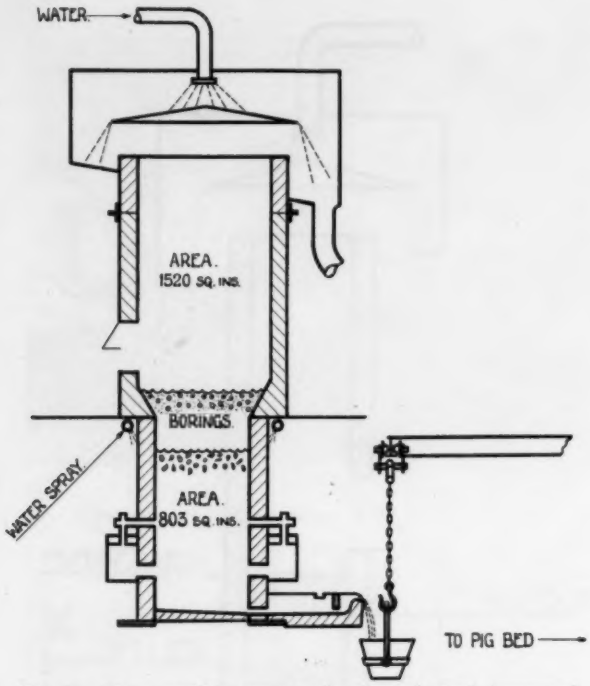


Fig. 7—32-in. melting zone and enlarged stack increased melting capacity and decreased stack losses.

accumulated over a month or two and if neglected caused a bad blow at the charging door. These slag particles also collected on the underside of the cone of the spark arrester until the crust finally fell on the top of the cupola closing it completely. The first time this was unexpected and the furnaceman, who did not understand what was wrong, was found patiently charging the furnace and extinguishing the burning roof beams alternately.

With these objections and defects noted, and after melting about 400 tons, the improved design was introduced.

32-in. Borings Cupola. The alterations consisted mainly of increasing the diameter of the cupola while retaining all vertical dimensions as before. The bore at the melting zone was increased to 32 in.; this made patching easy since the operator could work with some freedom. Since the cross-sectional area at the tuyere level was practically doubled and the air supplied by the same blower, the pressure was greatly reduced and the effective permeability of the charges increased. If this increase of diameter were carried too far it would be necessary to have a method of adjusting the area of the tuyeres nearest the air inlet to maintain equal distribution of air round the circle. The volume of incandescent coke in the bed being much greater, the effect of radiation losses and the tendency to uneven melting is greatly reduced.

The cross section above the charging platform was, of course, approximately doubled and the velocity of the gases further reduced. This, in conjunction with a small screening hood on the top of the door greatly improved working conditions close to the charging door. Naturally the amount of material carried up the stack was reduced. The weight of material recovered from the water trench was reduced to one sixth and and this made the iron loss up the stack 0.08 per cent of the iron charged. This seems to be the same as when no borings are used and it would appear that the loss of borings from this cause is now nil. The spark arrester is of the simplest possible construction and now requires no attention at all.

Water cooling on the outside of the lower section of the shell is effected by a simple circular spray causing a continuous film of water to run down into a trough formed on top of the wind belt by continuing the side of the wind belt up 2 in. all round. Though the conductivity of the brickwork is low (equilibrium between the cooled and heated surfaces would not be reached until the brick has been worn to 1¼ in. thick) the effect of the water on an eight hour run is quite significant. It was introduced as a safeguard against hot spots in the lining. These, however, has disappeared altogether with the improved melting conditions and proper patching.

The average melting rate has increased to 2010 lb per hr with maximum rates as high as 2300 lb per hr. This seems especially good when it is considered that the blower is only rated at 1 ton per hr for normal foundry melting. Thus, while the standard cupola may give only one third of its melting capacity on borings and small cleaning-room scrap, the specially designed cupola will give full capacity. Coke consumption remains the same at 400 lb per ton, the improved melting conditions having been offset by the increased bed coke, no account being taken of the quantity recovered for recharging.

Melting Loose Steel Turnings. Several earlier attempts (already referred to), were made to melt loose steel cuttings in the 32-in. foundry cupola, and in spite of heavy wear and tear on the lining, it was thought that the process could be carried out successfully. With this in mind, trials were carried out in the 32-in. borings melting cupola. It was observed that when using about 20 per cent by volume of steel cuttings mixed in cast iron, melting rate and tapping temperature appeared to improve considerably, with no serious loss in the lining. With about 60 per cent by volume of steel cuttings, the results were quite encouraging.

The steel itself was extremely varied. Some material was in the form of small curls, about ⅛ in. in diameter, and unusually light. Others from milling operations were equally small, and those from gear cutting machines were extremely thin and of large surface area, some being as small as fine cast iron dust. The cast iron borings were equally varied and appeared at times to carry a small amount of rust.

No Problems from charging

The charging was very simple and offered no problems. The mixing of cast iron and steel cuttings was haphazard so that at times the charge was all steel cuttings and the coke mixture was poor. It is necessary, of course, when melting steel of any kind, to allow for the extra coke which is dissolved in the liquid steel, but this point had been overlooked, and the furnace began choking up. As soon as the coke charge was rectified the furnace revived and continued at the normal melting rate. The metal at the spout was, of course, extremely hard and quick setting. The melt

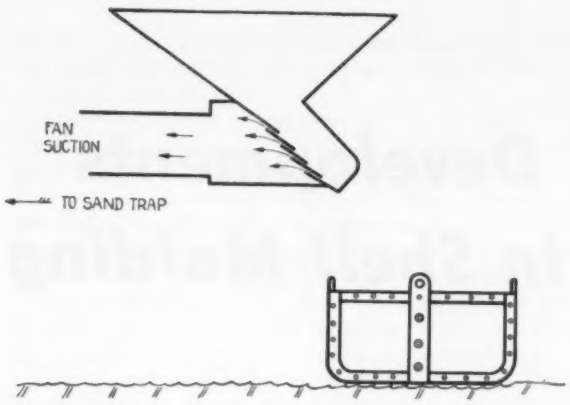


Fig. 8—Proposed device for sucking sand from cleaning room, sand plant, and cupola drop refuse to increase metal content and improve melting efficiency.

ran the normal time of 7 hr 10 min, and was successfully completed.

The main objection to the melting of such uncommonly thin material is said to be excessive oxidation. However, the quantity of slag and the general appearance was not unusual and the total loss from either cupola top or slag hole was less than many standard foundry cupolas. From this, and previous experiments, there seems little doubt that 100 per cent steel cuttings could be melted.

The precautions which would improve operation would be the use of the proper amount of coke of a smaller size, more in keeping with the size of the material—coke between 1½ in. and ½ in. probably would be ideal. Efficient water cooling of the outside of the cupola would be desirable, and perhaps basic lining and slag ought to be used.

During the melting of foundry small iron from the cleaning room, sand plant and cupola drop, where these materials are extracted from sand by electromagnet, the quantity of sand included with the metal amounted to 30 per cent by weight of the iron charged. While the furnace dealt with this quite successfully it obviously would be a great advantage to have this sand eliminated. A number of methods were considered and several tried, for example, tumbling wet and dry, riddling, etc. The continuous wet tumbler was too expensive to build and maintain.

It was therefore decided to use a cascade chute connected to a good suction fan placed under a suitable hopper. The material, as it comes from the foundry, can be dumped into this by the electromagnet and the dust and sand extracted as it slides down into the container. In this way, it is thought that the sand finding its way into the cupola with the charges will be largely eliminated, and more active desulphurization carried out. This would be a necessary step before consideration of a water-cooled basic lining whose main function would of course be completely cancelled out with the constant or erratic addition of silica sand and clay.

A further refinement under consideration is a continuous tumbler for cleaning small, heavily-rusted pellets prior to charging into the cupola. It is thought that practically all oxidation loss is due to oxide going into the furnace as such.

Conclusion. It would appear that the cupola will melt any ferrous metal from the full size of the charge door down to the smallest form of drilling and cutting.

Calendar of Future Meetings and Exhibits

May

2-6. . Electro Chemical Society
Chicago. Spring Meeting.

3-5. . Air Pollution Control Association
Patten Hotel, Chattanooga, Tenn. Annual Meeting.

4-7. . American Welding Society
Hotel Statler, Buffalo. National Spring Technical Meeting.

5-7. . American Society of Training Directors
Schroeder Hotel, Milwaukee. Annual Conference.

5-8. . American Welding Society
Buffalo Memorial Auditorium, Buffalo. Welding and Allied Industry Exposition.

8-14. . AFS Convention & Exhibit
Public Auditorium, Cleveland.

12-14. . Porcelain Enamel Institute
Chicago. Midyear Divisional Meeting.

16-19. . Industrial Furnace Manufacturers Association
The Homestead, Hot Springs, Va. Spring Meeting.

16-20. . Special Libraries Association
Netherland Plaza Hotel, Cincinnati. Annual Convention.

17-20. . Basic Materials Conference & Exposition
International Amphitheatre, Chicago.

25-29. . Eastern Seaboard Apprenticeship Conference
Equinox House, Manchester, Vt. Tenth Annual Apprenticeship Conference.

June

9-11. . American Society for Quality Control
Hotel Jefferson, St. Louis. Annual Convention and Exhibit.

13-18. . American Society for Testing Materials
Hotels Sherman and Morrison, Chicago. Annual Meeting.

14-15. . Malleable Founders' Society
Seigniory Club, Quebec, Canada. Annual Meeting.

July

13-15. . Western Plant Maintenance Conference & Show
Pan Pacific Auditorium, Los Angeles.

September

13-25. . First International Instrument Congress & Exposition
Philadelphia Convention Hall, Philadelphia, Pa.

19-26. . Associazione Italiana di Metallurgia
Florence, Italy. 21st International Congress of Foundry Technical Associations.

27-28. . Steel Founders' Society of America
The Greenbrier, White Sulphur Springs, W. Va. Fall Meeting.

October

6-8. . National Foundry Association
La Salle Hotel, Chicago. 56th Annual Meeting.

14-15. . Michigan Regional Foundry Conference
Ann Arbor, Mich.

14-16. . Foundry Equipment Manufacturers' Association
The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.

27-29. . Grinding Wheel Institute & Abrasive Grain Association
Edgewater Beach Hotel, Chicago. Fall Meeting.

After Three Years: Developments in Shell Molding

E. I. VALYI / *President, A. R. D. Corp., Yonkers, N. Y.*

Shell molding, like any new technique, continues to make regular improvement in materials, equipment and the process as a whole. Written discussion of this paper, Convention Preprint No. 54-75, should be sent to American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, Ill. The paper will be presented at a Sand Session of the AFS 58th Annual Meeting, Cleveland, May 8-14, 1954.

■ Industrial shell molding is now about three years old. The fundamentals, as described in numerous articles, serious publications and press releases, appear simple and attractive. Therefore, even though little detail and practical information was disseminated, the intrinsic appeal of the process caused an exceptional number of foundrymen to look into it. The results were good, middling, disappointing, or striking, depending on the usual factors of competence, skill, and ingenuity that were brought to bear upon the problem in the individual cases. Generally, out of all this activity, shell molding emerged as a valuable tool; the foundry industry, aided by most of those who have a legitimate interest in furthering the foundry business, applied itself with increasing intensity to the task of using it.

Many ingenious foundrymen and patternmakers proceeded to re-invent and improve shell molding. The industries supporting the foundry business, particularly the established purveyors of materials and equipment to the foundry industry have finally recognized it as a serious matter. Thus, it is not surprising that the improvements and developments are many.

It is almost impossible to gain the perspective for a review of significant advances in this ever fluid art; also, any day may bring something to change the face of the foundry industry all over again, as has been proclaimed every so often in these last few years. This presentation will therefore be a very modest attempt to point out some of the contributions to the art of shell molding that strike the writer as significant.

Purposes of Shell Molding. The advantages of shell molding, according to most of the promotional literature, relate to improved surface finish, greater accuracy, greater potential complexity, reduced machining requirements—in other words, basically increased value content of the foundry product. Emphasis on these aspects tends to relegate the process into a specialty category, perhaps somewhat like precision casting or plaster mold casting. It is not intended to minimize the potentials of shell molding along these lines, nor is it intended to underrate the need for the foundry industry to build more value into its product. One must bear in mind, however, that such increased value content is real only if rewarded by the buying public. Leaving specialty applications aside and viewing the vast majority of the repetitive

Fig. 1—View of sand coating plant. Sand and hexamethylenetetramine loaded into high speed muller (1) by skiphoist (2). Liquid resin added by metering device (5) while air, preheated in heat exchanger (6), is blown into sand. Coated sand is discharged on gyratory screen (7). Material dropping through screens is conveyed into cyclone collector (8) via air conveyor (10) and received in transfer container (9). Automatic cycle operated by controller (3). Courtesy Beardsley & Piper.

foundry product, it is not hard to see the above quoted advantages of shell molding are not going to fetch a premium early.

Therefore, these advantages will have to be accomplished at equal or lower cost, compared to current good sand foundry practice, without taking credit for savings past the foundry's shipping door. The main purpose of shell molding is reduction of cost of the casting and the measure of any advance is the amount it saves, to the foundryman first.

Cost of Binders. No single cost contribution in the manufacture of shell molds and cores is greater than the one attributable to the binder. Assuming a $6.00 a ton delivered sand price, a typical shell blend used to represent a materials cost of approximately 2.6 cents per lb not much over one and a half years ago. The binder resin sold for approximately 38 cents per lb at the time. The economic limitations of shell molding under such circumstances were soon obvious to all. In addition, the prospect of this new resin market gave rise to considerable competition for the favors of the foundry industry. Both factors contributed to benefit the foundryman, until the sand-resin blend finally dropped to a level of approximately 1.8 cents per lb (assuming the same cost of delivered sand as above).

In spite of its importance, this fact should not be listed among recent technical advances in shell molding since no technical developments appear to have caused them.

Suppliers of shell mold bonding resins have now probably approached that limit beyond which sound business thinking and precepts of fair pricing (fair both to the customer and to the producer) do not permit them to go. At the same time, it must be recognized that even this vastly improved price level of the sand-resin mix must be further developed in favor of the user. Since the means of economic competition appear nearly exhausted, one must now resort to development work on a technical level.

It accrues to the credit of the producers of bonding resins that they have engaged in intensive work to that end over the past two years with strong support from a number of experimenters in the foundry industry.

Coating of Sand. The technique of dry blending sand and resin was recognized right from the start as neither particularly efficient from the standpoint of resin distribution, nor pleasant to carry out. In addition, a dry powder blend imposes definite limitations upon its use, due to segregation under certain otherwise desirable operating conditions. The great difference in specific weight and in particle size of the two components makes it obvious that any strong acceleration or deceleration will promote segregation of resin and sand. Thus, in the case of blowing, the blend has to be carried at high velocities in the blowing medium; segregation will contribute to uneven bonding, creation of voids, and the like. Moreover, many of the conventionally useful means of conveying, such as high speed bucket elevators, vibratory and air conveyors, and the like, may not be used.

The economy of bonding depends upon bond distribution, i.e., upon the chance of finding bonding material present wherever needed between sand grains. If favorable bond distribution can be made permanent by some means of attaching the resin to the sand, then the tendency to segregate will be overcome at the same time.

Fig. 2—Sand box during coating. Sand drops from constant height through louvers (1) on pattern (2). Photo courtesy Shellmold & Machine Co., Inc.

For theoretical optimum bonding economy, one must visualize the resin concentrated at points of contact of adjacent grains of sand and the latter provided with means to hold fast onto their respective particles of resin. Next to this impossible solution of placing a particle of resin at the contact area of two adjacent sand grains and nowhere else, the logical approach is to coat the sand grains all over with bonding resin.

That method of bond distribution is, of course, not in itself spectacular or new; the foundry industry is in the habit of coating with a bonding medium whenever a muller, pug mill, or similar device is used to incorporate bond with sand. The resin industry is quite used to an analogous technique in the manufacture of bonded abrasives. Since the idea of incorporating a bond by way of coating is comparatively old, a word of explanation may be in order to show why the principle of coating was—and still is—so difficult to apply in the case of a shell mold bonding system.

As recognized early in the formulation of phenol formaldehyde resins for sand bonding in the shell mold process, only so-called two-stage resins may be employed. The single-stage resins, or resoles, are distinguished from the two-stage resins, or novolacs, in that they are chemically predisposed for progressive polymerization, even at ambient temperatures of the average plant, changing their properties continuously, which is intolerable in shell molding.

This instability is unfortunate when viewed from the standpoint of coating, since the single-stage phenolic resins, such as the conventional phenolic core

Fig. 3—Automatic shellmolding machine with vertical sand drop. Photo courtesy Shell Process, Inc.

binders, are very readily available in liquid form.

Two-stage phenolic resins are difficult enough to provide with the properties that make them suitable for shell molding. It is even more difficult to formulate them so as to leave them with these desirable properties after coating the sand.

Several methods of coating can be conceived of, such as: dissolving the resin in a suitable vehicle which will then provide the medium for coating; imparting plasticity to the resin by heating it; coating with a liquid resin first and allowing it to polymerize in situ.

The two-stage resin is not a single material, but a mixture of a phenol formaldehyde (novolac) and hexamethylenetetramine; the latter, once it decomposes under the influence of heat, furnishes a basic catalyst (ammonia) and the necessary formaldehyde to further and complete the polycondensation reaction. Dissolving this mixture of phenol formaldehyde and hexa is in itself not difficult. However, the coating deposited upon the sand from such solution is not the same as the original resin, nor is the process of admixing this solution to sand a simple, efficient, and effective one. Attempts at coating, wherein an otherwise suitable dry two-stage resin is dissolved in, say, alcohol and admixed with the sand in a blender or muller, are usually unsuccessful due to non-uniform conditions encountered during the exothermic course of the process, due to lumping of the blend, high loss, and other causes. The resultant coating appears non-uniform and in most instances quite brittle.

It is felt that these solvent coating procedures fail primarily because they do not permit adequate control of the critical balance between rate of precipitation, solvent evaporation, and temperature during mulling. Nor has an attempt been made so far to formulate a resin specifically suited for alcohol solvent coating.

A modification of solution coating consists of a method wherein a dry blend of the sand and the two-stage resin is prepared first, to which the solvent is then added as a fine spray, under conditions that permit no more than softening of the resin surface, sufficient to cause adherence to grains of sand.

Successful coating procedures from an alcohol solution would be highly desirable, since they would permit the use of equipment that is usually available in a foundry anyway. The fact that the attempts along these lines have not met with good success as yet does not mean that the cause is hopeless; to the contrary, further work along these lines should be encouraged.

The other approach to the coating problem, at the moment by far the more successful, is known as the hot mulling process. In that procedure, a liquid two-stage resin is employed. Figure 1 shows a typical installation carrying out hot coating of sand. The sand, together with the hexamethylenetetramine, is fed into a high speed muller and the hexa first completely distributed in the sand. Thereafter a "liquid novolac" is added to the sand under simultaneous application of heat by way of a hot air stream blown through the muller Under the influence of heat, the resin will progress towards a higher degree of condensation, no doubt under some employment of the hexa present. In other words, the resin will advance, until it is transformed from a liquid to a solid. After sufficient action of heat, the batch is cooled with water, stopping the reaction, and dumped from the muller from which it emerges in a highly friable, lumpy condition, to be subjected to attrition and breaking up into its original particle size.

Actually, the process of hot coating is very closely related to the solvent coating process, except that the formulation of the resin is apparently chosen to permit the employment of a particularly logical solvent, which had not been thought of in previous attempts of solvent coating, namely excess phenol. Even fairly low molecular weight polymers formed in the phenol formaldehyde reaction are solids, so that the term "liquid novolac" is not really accurate. What such liquid resins seem to consist of is a suitably polymerized phenol formaldehyde with excess phenol. This excess phenol will partly evaporate in the course of hot mulling, and partly perhaps also continue to react with available formaldehyde while the polymerization process continues.

Temperature Favors Hot Coating

Room temperature strength of shells produced with the same quantity of resin, either dry blended or hot coated, will differ by a factor of 3 to 5 in favor of hot coating. It was deduced thereupon that a much lower resin content is permissible, which is by no means universally borne out. Still, it is interesting to speculate upon the reasons for this difference in strength. Observation of a resin-sand blend under the microscope during progressive flow and bonding shows that the resins acquire extremely high fluidity very rapidly, once the proper temperature levels are approached, and that the capillary forces acting between adjacent sand grains cause rapid migration of the fluid resin to the contact areas of sand.

A coated sand, under the same conditions, shows that much of the resin on the sand surfaces is too far

from contact points to do any good and that migration is not accomplished as readily as with a dry admixed resin particle that happens to find itself in a favorable location between sand grains. In other words, the dry blend results in bulkier and more substantial resin bridges between sand grains wherever such bridges are found. As in glass and many other amorphous materials, the thinner a layer, the higher the specific strength. The theories explaining this fact can be rather involved and have been dealt with on the basis of the probability of occurrence of internal defects, the probability of formation of cleavage planes and the like; at any rate, some such effect appears to be present in the case here reviewed.

Hexa Particle Breakdown

In addition, there may be another contributing factor to the higher strength of coated sand. Bond strength will depend not just on the relative position of phenol formaldehyde and sand grains, but also on availability of a hexa particle sufficiently near so that its breakdown products can perform their function effectively. In a coated sand, good distribution of resin and hexa can be relied upon, while in a dry blend the prerequisite of a homogeneous resin (novolac) and hexa blend is not always and not necessarily fulfilled.

From the standpoint of economy and its ability to form a shell or core of high strength, the coated sand is a superior product. Unfortunately, upon final evaluation by way of a casting produced in a mold made from such sand, the results are not quite satisfactory as yet. This, however, need not discourage anyone since it would appear that the defects found with the use of coated sands are amenable to elimination with some additional patient effort. The resins available for coating are not yet sufficiently developed to yield best and most economical conditions of flow, cure rate, mold flexibility for stripping and closing, as applied to a wide variety of possible applications. Another and more important defect is that of inferior surface finish, tendency for penetration and apparent lack of hot strength associated with coated sands.

It is felt that some research is in order, under recognition of the factors that had a bearing upon penetration in dry-blend shell molds. The coating process applies a reasonably uniform resin coat to all particles in the system. It is questioned whether this is advantageous and whether it would not be preferable to have certain fractions of the sand coated in different ways and to different degrees. If this should be so, then it is felt that it will be a matter of comparatively simple experimentation to establish just what amount of coating to apply to which particle fractions of sand.

The reason for this assumption stems from observation of dry-blend shell molds, which usually show accumulation of fines at the pattern side and evidence of a generally denser structure immediately adjacent the pattern. This appears to be the consequence of the action of resin while in a highly fluid state for a short time, permitting the sand grains to rearrange themselves, aided by buoyancy in the liquid medium. As a result some fines migrate to the proximity of the pattern during the short interval, filling in some of the interstices between coarser grains of sand. At any rate, the effect is the production of a smooth, penetration-resistant layer at the metal-mold interface. As against this, the particular distribution in a coated sand is very uniform and does not follow the above described pattern, nor does it change in the course of the molding process.

The resin content generally chosen to prepare a coated sand is based on some average ratio of surface area of sand to weight. The finer the sand, the more resin is usually recognized as being required for equal bonding. It is probable that any such average appraisal is far from correct and that the resin content available for the finer fractions of sand should be different from the coating of the coarser particles. To raise the total resin content in keeping with the amount of fines of the sand is probably an easy way out in the wrong direction; once the coating process requires the same resin content as used in dry blending, a major advantage of coating disappears rapidly.

The subject of coated sands is fascinating and perhaps the one of greatest importance from a technical standpoint in the field of shell molding today. Progress may be expected towards solution of the surface finish problem, perhaps as above indicated. The use of coated sands will not only enhance the economy of the process, but also make possible certain means of mold and core production, air conveying and the like, which the dry blend process does not permit.

Shell Forming. The point of departure in shell molding is the application of sand to the heated pattern, followed by the removal of the excess after preliminary bonding. The progress of change in the binder is extremely rapid during the first few seconds of contact with the hot pattern surface. In a period lasting a fraction of a second up to perhaps one and a half seconds the resin will have progressed from extreme fluidity to very substantial viscosity. The correspondingly narrow time interval within which detailed flow against a pattern contour can take place explains much of the difficulty encountered in proper application of the sand upon the pattern.

The simple pattern with few pronounced contours and no deep draws will not show up differences, no matter how the sand is thrown against it. Unfortunately, the majority of patterns in the foundryman's experience are complex and deep. In what might be termed the average pattern, effective coating is accomplished only if all portions of the pattern are brought into contact with the sand mix at about the same time, without giving the resin an opportunity to bridge, round corners, or otherwise keep sand grains from coming into intimate contact with pattern areas. Patterns with numerous near-vertical planes, whether above the plate line or below, with narrow wedge-like areas, with comparatively deep holes, turn out to be quite difficult to reproduce.

To produce a satisfactory coat in all cases, the sand must be dropped from a minimum height of approximately 10 in. to 12 in. in order to reach the pattern with sufficient impact. The drop height must not be so great as to cause segregation in a dry blend.

In addition to ascertaining that the sand will drop over a minimum height and that all portions of the pattern will come into contact with the sand at substantially the same time, it is also important to make

sure that the overlay of sand will be about the same at all times.

To devise a sand box (variously called dump box, applicator, investment box, etc.) in keeping with these principles, a two-compartment system was resorted to with great success, wherein the sand is held at a constant height above the pattern, the subdivision of the box being by way of a set of louvers or some other suitable partition. Figure 2 shows a typical sand box constructed along these lines. Figure 3 shows a machine that embodies the principles above outlined, just before the coating operation.

This system of sand application provides certain indirect advantages beyond the coating step: the process can now start with the pattern plate right side up, instead of a roll-over. It is therefore easily possible to use loose pieces in the pattern without the need to tie them down in a complicated way. Moreover, no provisions need be made to keep stripper pins from falling through the pattern plate away from the pattern face. The pattern is inverted only after a shell is formed and even the uncured shell is strong enough to retain light stripper pins during dumping. While this does not appear to be a significant advance, it does contribute greatly to the economy of pattern making, particularly where pattern cost is a great factor.

Pattern Heating and Curing. Next to proper sand application, the most critical aspect of shell molding is the control of temperature in the pattern and the maintenance of the necessary heat without loss of time and extension of the molding cycle.

Heat is extracted from the pattern with each cycle due to contact with the cold sand. Heat is also lost by the pattern during any operation of the process that does not take place within the oven, such a stripping, mold conditioning with parting agents and the like. In order to replenish this lost heat, it was customary to insert the pattern into an oven before any subsequent coating operation and leave it there until it has reached the proper operating temperature again; alternately, electric heaters were built into the pattern. Lengthy preheating before each cycle is obviously wasteful of time. Electric heaters add considerably to the cost of the patterns; they are comparatively ineffective in most cases, since space limitations prevent accommodation of a sufficient number for maintaining a steady temperature.

Obviously, heat can best be replenished without cycle extension by utilizing the time period during which the pattern is in an oven anyway, for curing. During that time, however, the pattern is effectively insulated from the oven heat by the mold blanket above it. Means to add heat to the pattern during the curing cycle were more difficult to find than would appear on the surface and while advances in heating methods were many in the last two years, one will easily recognize as the most important one the construction of curing ovens which effectively accomplish heating of the pattern while curing takes place.

It will be remembered that the time element in shell molding is paramount from the standpoint of production economy; therefore, all heating cycles have to be carried out at high temperature levels which, in turn, may render control and overall cycle balance quite difficult. The best solution of the problem seems to be provided by a combination of radiant and convection heat which appears to be extremely effective for simultaneous curing and pattern heating. The radiant source is applied primarily to the bare pattern, in which conductivity aids temperature distribution, and convection heat to the mold. This permits substantial reduction, if no elimination of any preheating between cycles, without attaching heaters to the pattern equipment.

Mold Making. A mold can be made only if its two or more components can be brought into satisfactory register and securely assembled to receive molten metal. Accuracy of the mold assembly is largely governed by the ability of the parting surfaces to match. Rigid shells are not capable of accomplishing this; even more important, they are not capable of coming off the pattern in the first place. Therefore, assembly of the mold hinges upon proper control of the molding cycle, such that the pattern yields flexible and deformable shells. This is emphasized in the light of much misunderstanding along these lines.

Starting with the molding operation, one can readily see that the shell is being heated from two sides, namely from the pattern and from the curing oven. It is completely impractical to balance these two sources of heat with such a degree of accuracy as to offset differences in temperature. Deformation of the shell is the consequence of these temperature gradients. If curing is carried to the point at which the shell is rendered completely rigid while it is still on the pattern, minor deformations due to temperature gradients will cause the average shell to bind upon the pattern, making it extremely difficult, if not impossible, to strip.

Even where a completely rigid shell has been successfully stripped from a pattern, the problem of matching two shells, each slightly warped, has yet to be solved. In most cases such shells just cannot be brought to register. Thus, the curing operation must be so adjusted as to yield shells that are flexible during stripping and still flexible while assembling the mold, or at least flexible enough to be straightened against a plate after stripping. A process of mold closing, (Fig. 4), successfully developed during the past two years, will guarantee perfect register of mold halves, providing they were made under conditions of cure that permits the requisite deflection and adjustment of the two mold halves to each other. Developers of this process, have gone one step further in that they utilize the matching procedure very logically for the simultaneous application of a mold cement.

In this process the freshly made shells can be subjected to pressure, either to straighten and cool, to be assembled thereafter, or two mold halves are closed while at least one is still hot and flexible, the assembly subjected to pressure and thereby the two mold halves matched against each other. The pressure is usually applied by way of a spring fixture that exerts force against the mold halves in selected spots, avoiding the mold cavities and preferably in such locations that appear logical for the application of mold cement or paste. This process of mold closing has met with remarkable success, not only in its originator's plant, but also in many other installations. The equipment is now commercially available.

Reliable and inexpensive methods of preparing shell molds for pouring were recently developed. With light castings of comparatively low static pressure and reasonable wall thickness, the rate of degradation of the shell molds can match the rate of solidification in such a way that the mold will hold fast long enough for the casting to solidify. The above described procedure of bringing the mold halves into perfect register, combined with the strong sealing bonds that can be developed with the aid of synthetic resins when applied to the mold while it is still hot, have resulted in cementing of the molds together with sufficient strength to withstand the lifting pressure.

With high metallostatic pressures within the mold and very heavy castings, it is still necessary to support the shell mold further if for no other than economic reasons. Increasing the thickness of the shell lengthens the production cycle and also wastes a great deal of resin bond. The preferred backing medium for shell molds is not shot, as oftentimes reported, but rather normal green sand applied against the mold by tamping, jolting, or slinging. Elimination of shot backing, again, is a simple thought, but at the same time an effective one. It was recognized that the shell mold has sufficient permeability to vent through its thin edge and that it may be backed with a very dense medium without ill effects upon the casting.

How big may a shell mold casting be? A shell mold embedded in green sand is after all no more than a green sand mold with a facing and it is known that there is no limit to the size of such a mold. Obviously, backing with sand is a different matter than green sandmolding; there is no need to watch out for mold hardness, careful stripping from a pattern, careful matching, and the like. Therefore, the cost of sand backing is insignificant.

Shell Cores. While much was written in the past on the subject of shell making, there is comparatively little indication of the methods employed in the making of shell cores. This is to be regretted, since it would appear that the economic potentials of shell core making are very great.

One of the prerequisites of shell core making is the need to make true shells of uniform wall thickness; an increase of wall thickness of the shell core will tend to render core collapse and shakeout difficult, if not impossible, since shell cores are extremely heavily bonded, as compared to conventional core practice. The thickness of the shell core, as in molding, is dependent upon time of contact with the heated core box and upon the core box temperature. To control and minimize, if necessary, time of contact, both the introduction of sand into the core box and the removal of the excess sand from the core box must be accomplished effectively, rapidly, and under consistent conditons. A shell is properly formed only if the sand impinges upon the heated surface of the pattern or core box with a certain minimum impact. As applied to a core box, the sand should be introduced at comparatively high velocity, such as in blowing, or else the sand must be dropped against each core box wall.

Blowing is still a very limited technique and will be as long as the problem of sand coating remains somewhat unresolved. Core making by dumping needs considerable ingenuity, not only to cover the usual

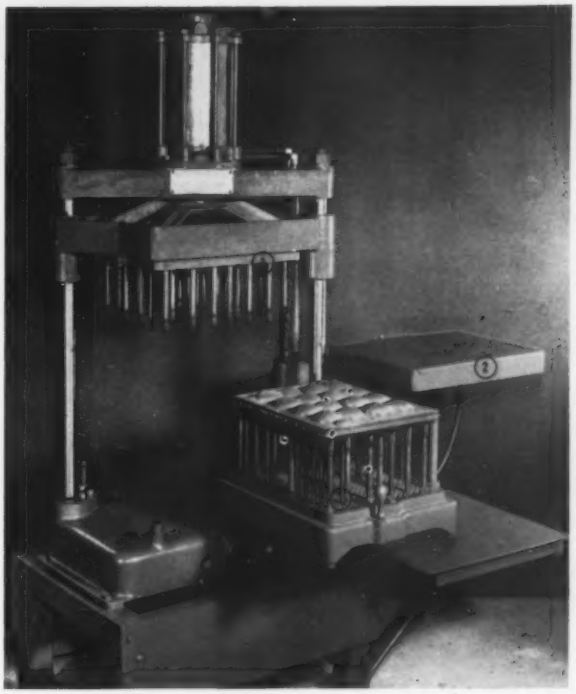


Fig. 4—Mold closing process. Drag shell is placed on spring pad (1), swung under resin sealant dispenser (2) and sealant applied. With cores and cope set, mold is swung between spring pads (1) and (3) and closing pressure applied through interval controlled by timer (4). Photo courtesy Shell Process, Inc.

aspects of core box design, but also to provide means of dropping within the core box, perhaps from one inside face to another, so as to assure impact. In the dumping procedure of core making, one cannot work fast enough. One successful method is usually to introduce at first a smaller quantity of sand than required to fill the core box completely but more than enough to coat it and then build up one or more additional layers in subsequent operations. While this "slushing" may sound cumbersome, it is actually much simpler and less costly than it sounds, since all of it is performed extremely fast.

While very complex cores can be made in this fashion, foundrymen look forward to the day when blowing will be made easy with the aid of coated sand. Anticipating that time, one can also foresee considerable changes in the methods of mold making. Techniques are available even now for the production of blown molds that eliminate the current need for dumping, roll-over and re-inverting. With a coated sand that can be conveyed by an air stream, it will be possible to construct a molding machine with a stationary pattern.

While there is sufficient reason now for any foundryman to take interest in shell molding, to apply it widely and to learn as much about it as possible, it is safe to anticipate that the improvements now in store, through utilization of more evenly distributed, lower cost binders and reduced time cycles for molding and core making, will bring shell molding to heights far above the economy of current foundry practice.

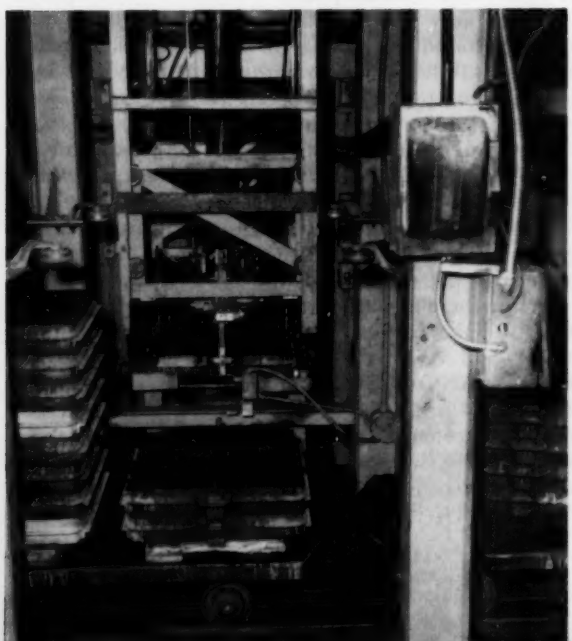
Blow-squeeze machine with pattern down and flask in position ready to be blown and squeezed.

Modern Foundry Methods

Automatic Mold Stacking

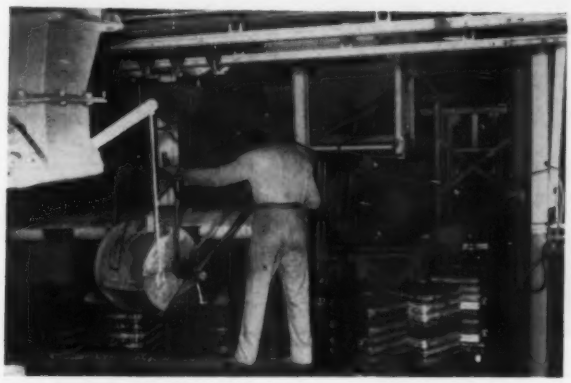
GREG MINOGUE/*Staff Writer*

Mold stacker devised by Albion engineers, in position, ready to pick up mold ejected by machine and place it on top of stack on mold car.



INCREASING production and improving working conditions by improved methods is the goal of officials at Albion Malleable Iron Co. Albion, Mich. In keeping with this policy they have installed two new type blow-squeeze machines for stack molding. The machines are push button operated, fully automatic, one cycle operation and are controlled by electric motor driven cam timers which actuate solenoid valves. The time cycle from the time the start button is pushed until the complete mold cheek is ejected is 12 seconds. The units at the present time are being used for the production of rocker arms for automobiles.

Albion engineers have devised mold cheek stackers for use at the machines. The stackers have been synchronized to operate automatically with the blowing and squeezing of each flask. The flask, which is filled by the push button operation, is picked up by the stacker after it has been blown and squeezed and carried to the mold car where it is stacked on top of the other completed mold sections or cheeks on the car. Flasks are stacked eight and ten high. After the cheek is in position, the stacker returns to the mold blower to pick up another mold section and the cycle is repeated.

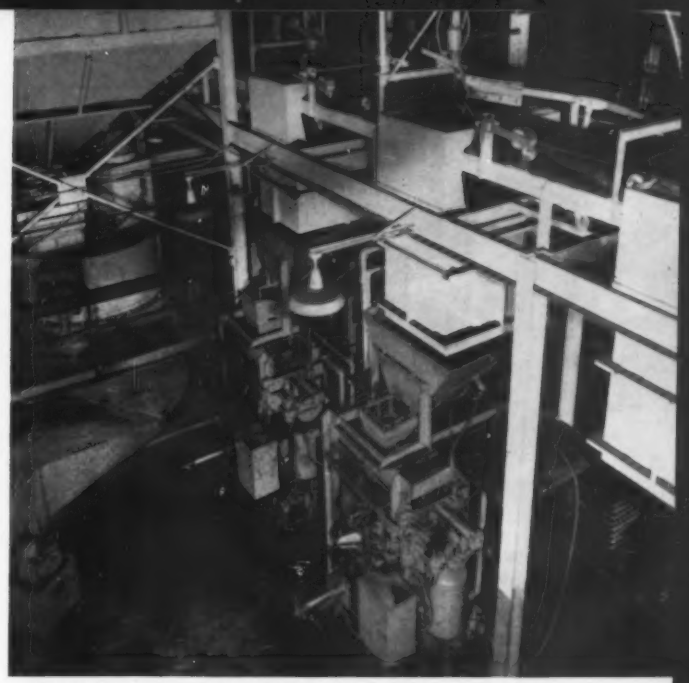


Pouring the stacks; mold stacker can be seen in upper right background (see pg. 144 for closeup).

One man operates each machine, the only manual operation required being the placement of the empty flask in position on the mold blower and pressing the starting button.

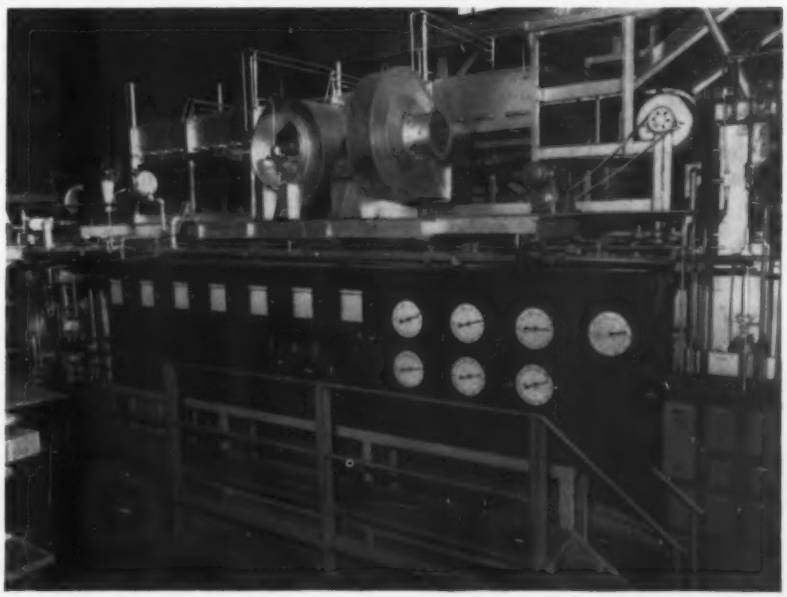
Each flask is fed in and out of the machine on a roller wheel conveyor extending from under the blowhead beyond the front of the machine. Horizontal rollers along the conveyor contact the sides of the flask and help to guide it over the bottom plate. Steel runners, protruding from the flask sides, ride on the conveyor wheels. The flask is placed on the conveyor and pushed under the blowhead manually. A micro safety switch, actuated by the flask when it is positioned properly, closes a circuit; this permits the machine to run through its cycle when the start button is pressed.

Operation of the machine is controlled by an electric cam timer. The machine is closed pneumatically, with the lower plate being raised to engage the flask on a steel wear strip and lift it off the rollers. The blowplate and squeezer plate descend, and a similar wear strip on the squeezer plate contacts the upper edge of the flask. Squeezer plate is held in position hydraulically.

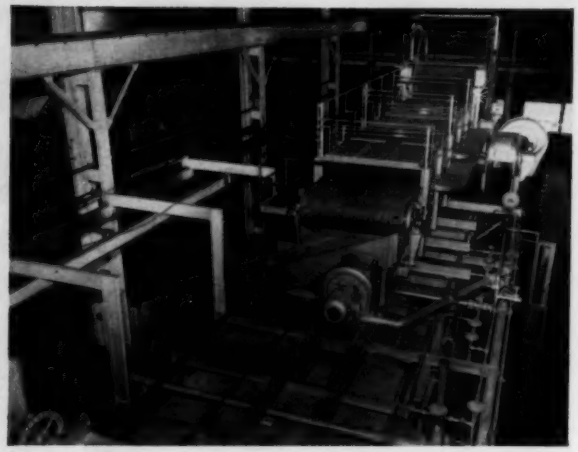


Unit No. 5, showing mold machines and sand muller.

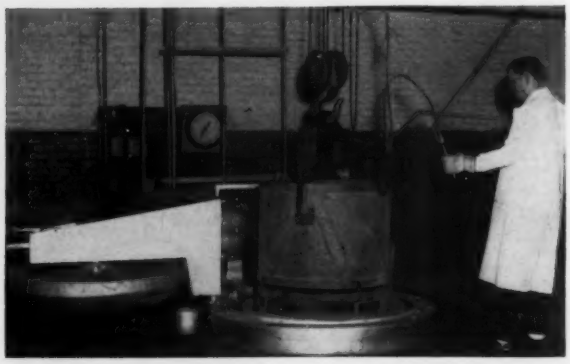
Unit No. 5 mold shake-out. Hood to collect smoke and dust from dumped molds is shown at the left.



Control panel alongside annealing furnace. Quenching unit appears at top of picture. Round-face controls are used on this furnace and square faces on hood-type furnaces, which are used with No. 9 and 10 continuous furnaces for production of ferritic malleable iron.



Air-quenched castings emerge from cooling chamber on conveyor belt above first-stage heat treating furnace.



Pit-type draw furnace, one of those used at Albion for tempering air-cooled pearlitic malleable iron.

Semi-automatic grinding machine in operation.

After the start button is actuated the sand magazine is closed by means of a shuttle in the top section of the machine. This shuttle contains a rubber sealing ring which seals the sand magazine when the rising table clamps the flask; next all exhaust valves are closed and the blow valves opened. The universal blowplate contains 27, 7/8 in. diam.; 4, 3/4 in. diam.; 12, 1 in. diam. blowholes. Slotted vents are used. The plates had an important part in the development of the mold blower in that they permitted the spent air to escape other than through the pattern.

The mold is squeezed by letting out fluid from the hydraulic cylinder holding the squeeze plate in position, permitting the upper pattern plate to lower. When the squeeze is completed, the upper and lower plates are vibrated and drawn back to a starting position. The completed mold section is deposited on the roller conveyor as the lower plate drops down. An air ram pushes the flask out of the machine and into position to be picked up by the mold stacker.

A pallet-type conveyor encloses a small rectangular area 23 x 56 ft, the machines being located inside the conveyor loop. Space has been allocated for a third machine of the same type to be installed shortly. A complete sand system and the conveyor drive are also located within the confines of the mold car conveyor area.

Flasks measure 3 x 18 x 18 in. and contain about 60 pounds of sand. Maximum sand requirements for each machine are about 70 tons during an eight hour run. Stack molds have a sand to sand contact rather than flask to flask contact. This prevents metal from running out and damaging the flasks and also permits gas to escape at the parting during the pouring. Sand used is 50 per cent bank sand and 50 per cent lake sand giving an AFS grain fineness of 75. Typical properties are: permeability, 68; moisture, 3.5 per cent; green compression, 15.4 psi average; deformation, 0.022 in. per in., and flowability 75 per cent.

After the blown flasks are stacked on mold cars, they are carried to the pouring platform along one end of the conveyor. Pallets measure 24 x 53 inches and hold two stacks of flasks.

From the pouring station, the conveyor moves the stacks through a smoke tunnel and then to the shake-out. Stacks are picked up by air-hoist from the mold cars and carried by monorail to the shake-out.

Production is controlled by machine time cycles. At a cycle of 12 seconds, one machine can produce at an ideal or optimum rate a complete stack ten cheeks high in 2 minutes.

From the shake-out, castings are transported by lift truck to a spruing and sorting belt. After spruing and an initial inspection, the castings are placed in a continuous annealing furnace for the first stage of the pearlitic heat treatment. After passing through the furnace, the work is mechanically raised and deposited on a mesh conveyor belt located in a water walled quenching chamber above the annealing oven, where it is cooled by a rapidly moving stream of air. At this point some castings are reheated, oil quenched and drawn. Others are drawn directly after air cooling, dependent upon metallurgical requirements.

After cooling on the conveyor belt, air quenched castings are placed in pit-type draw furnaces for tempering. All phases of heat treating follow conventional practices with respect to times and temperatures.

Castings are then cleaned by shotblast, ground, inspected and shipped. Rocker arm grinding is done on semi-automatic grinders of the turn-table type. Ground castings are automatically ejected by air blast. Up to 3600 pieces can be ground in an hour.

Conforming Specifications for Copper-Base Alloy Castings

Reprinted from *COPPER-BASE ALLOYS FOUNDRY PRACTICE*, published by American Foundrymen's Society.

Conforming specifications for the copper-base casting alloys are listed below. Since these specifications are changed frequently, the year suffix on the ASTM specifications and the lower-case letter suffix on the Navy specifications have been deleted.

The table is only a cross reference for the various organizations drawing up specifications, and should not be used as a basis for production. It should be used as a guide. A producer should secure the latest versions of the specifications indicated before beginning production, so that he may be sure that he has the correct data regarding chemical composition and minimum mechanical properties. Names and addresses of the organizations from which copies may be obtained are given below.

ASTM—American Society for Testing Materials, 1916 Race Street, Philadelphia.

Federal—Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

Navy—Bureau of Supplies and Accounts, Navy Dept., Washington, D. C.

Military—Bureau of Supplies and Accounts, Navy Dept., Washington, D. C.

SAE—Society of Automotive Engineers, Inc., 29 West 39th St., New York.

AMS—Aeronautical Materials Specifications of the Society of Automotive Engineers, 29 West 39th St., New York.

CONFORMING SPECIFICATIONS FOR COPPER-BASE ALLOYS

Class	Alloy	ASTM	Federal	Navy	Military	SAE	AMS
Tin Bronze	88-10-0-2	B143(1A) B30(1A)† B22-D				62	4845C
	88-8-0-4	B143(1B) B30(1B)†	691-5 701-5†	46M 6 46B25-III†	16576	620	
	85-15	B22-B	691-9 701-9†	46B22-III	16261		
	81-19	B22-A	691-10 701-10†				7322
	89-11					65	
Leaded Tin Bronze	88-6-2-4	B143(2A) B30(2A)† B61	691-1 701-1†	46B 8 46B25-I†	16541	622	
	87-8-1-4	B143(2B) B30(2B)†	691-6 701-6†	46B 5-I	16540	621	
	87-10-1-2						4846
	88-10-2-0					63	
	87-11-1-0-1					640	
High Lead Tin Bronze	80-10-10	B144(3A) B30(3A)† B22-C				64 792	4842 4827C
	83-7-7-3	B144(3B) B30(3B)†	691-12 701-12†	46B22-VI	16261	660	
	85-5-9-1	B144(3C) B30(3C)†				66	

continued next column

Class	Alloy	ASTM	Federal	Navy	Military	SAE	AMS
	78-7-15	B144(3D) B30(3D)† B66	691-7 701-7†	46B22-IV	16261		4825A
	70-5-25	B144(3E) B30(3E)† B66-B67		46B22-V	16261		4840
	84-8-8		691-8 701-8†	46B22-II	16261		
	71-13-16		701-13†	46B22-VIII	16261		
	75-5-20	B66		46B22-I	16261	794	
	81-8-11	B66					
Leaded Red Brass	85-5-5-5	B145(4A) B30(4A)† B62	691-2 701-2†	46B23 46B25-II†	16444	40	4855A
	83-4-6-7	B145(4B) B30(4B)†		46B 5-III	16540		
Leaded Semi-Red Brass	81-3-7-9	B145(5A) B30(5A)†	691-4&11 701-4&11†	46B24 46B 5-III	16540		
	76-3-6-15	B145(5B) B30(5B)†					
	80-5-2-13		691-3 701-3†	46B21	16542		
Leaded Yellow Brass	71-1-3-25	B146(6A) B30(6A)†	621-C	46B11-II			
	67-1-3-29	B146(6B) B30(6B)†	621-B	46B11-I		41	
	63-1-1-35	B146(6C) B30(6C)†	621-A	46B10			
Manganese Bronze	60-20-15*	B147(7A) B30(7A)† B132-A	726-D 731-D†				
	65-25-20*	B147(8A) B30(8A)†	726-A 731-A†	49B 3 46B25-V†	16443	43	4860
	90-45-18*	B147(8B) B30(8B)†	726-B 731-B†	46B29-b 46B25-VII†	16522	430A	
	110-60-12*	B147(8C) B30(8C)†	726-C 731-C†	46B29-a 46B25-VI†	16522	430B	4862A
Aluminum Bronze	88-3-9	B148(9A) B30(9A)†	671-A 675-1†	46B18-1 46B19†‡	16033	68A	
	89-1-10	B148(9B) B30(9B)†	671-B 675-2†	46B18-2	16033	68B	
	(86-4-10 or (84-4-10-2	B148(9C) B30(9C)†	671-C 675-3†	46B18-3	16033		4870-71 4872-73
	79-5-11-5	B148(9D) B30(9D)†	671-D 675-4†	46B18-4	16033 6947		
Nickel Silver	12% Nickel	B149(10A) B30(10A)†					
	20% Nickel	B149(11A) B30(11A)†		46C12			
	25% Nickel	B149(11B) B30(11B)†					
Silicon Bronze	1-5% Si 5% Zn. max.	B198(12A)	C-593	46B28-b			
Silicon Brass	2½-4% Si** 3-5% Si**	B198(13A) B198(13B)		46B28-a 46B28-a			

*Mechanical properties of the manganese bronzes.
**12 to 16% zinc.
†Specifications are for ingot.
‡46B19 superseded by QQ-B675-1.
ASTM—Year suffix not listed.
Federal—All specifications prefixed by QQ-B except QQ-C-593.
Navy—Small letter suffix not listed.
Military—All specifications prefixed by MIL-B except MIL-M-16576. These Specifications supersede Navy Specifications in column to the left.

Specific Applications of Copper-Base Alloys

Reprinted from *COPPER-BASE ALLOYS FOUNDRY PRACTICE*, published by American Foundrymen's Society.

The original compilation of specific applications of copper-base alloys was made using *Engineering Alloys* by Dornblatt and Woldman as a basis. The revision was made using the original list of applications and by reviewing all copper-base alloys listed in the latest edition of the *Engineering Alloys* by Woldman and Metzler. The final draft of these specific applications in no way resembles the material given in the previously mentioned volume, and is assembled as shown below for quick and easy reference.

USES OF COPPER-BASE ALLOYS GROUPED ACCORDING TO SPECIFIC ALLOYS

Alloy	Uses and Applications	
Nickel-Tin Bronzes	Bearings Gears	Wear Plates Worm Gears
High-Tin (10-20%) Bronzes	Bearings: Bridge Electrical Machinery Rolling Mill Locomotive Machine Tool Trunnion Turntable	Bells Gears Piston Rings Worm Wheels
88-8-0-4	Bearings: Bridge Machine Tool Trunnion Fuel Pumps Impellers Injectors Paper Machinery Piston Rings	Pump Bodies Railroad Fittings Steam Fittings Trolley Wheels Valve: Discs Seats Stems Gears
88-6.5-1.5-4	Bearings Carburetors Cocks and Faucets Flanges Fuel Pumps Impellers Injectors Paper Machinery Pump Bodies Railroad Fittings Steam Fittings	Statuary Valve: Discs Seats Stems Valves: Air Compressor High Pressure Hydraulic Steam
85-5-5-5	Architectural Bearings Carburetors Cocks and Faucets Fixtures Flanges Fuel Pumps Impellers Injectors Memorial Markers Meters and Parts Paper Machinery	Piston Rings Pump Bodies Marine Fittings Statuary Valves: Hydraulic Steam Valve: Discs Seats Stems
81-3-7-9	Cocks and Faucets Fixtures Flanges Marine Fittings	Ornamental Statuary Valves: Hydraulic
80-10-10	Bearings: Machine Tool Electrical Machinery Pump Railroad Rolling Mill Self Lubricating Trunnion	Impellers Paper Machinery Pump Bodies
77-8-15 to 65-5-30	Bearings: Locomotive Pump Railroad Rolling Mill Self Lubricating Gas Engine Diesel Engine	Impellers Paper Machinery
Yellow Brass	Architectural Band Instruments Carburetors Cocks and Faucets Fixtures Lamp Fixtures Locks	Medallions Meter Parts Paper Machinery Railroad Fittings Ornamental Statuary Valves
Manganese Bronze	Architectural Ball Bearing Races Bearings: Rolling Mill Trunnion Gears	Gear Shifter Forks Impellers Marine Propellors Marine Fittings Valve Stems Worm Wheels
Aluminum Bronze	Ball Bearing Races Bearings: Rolling Mill Machine Tool Gears Gear Shifter Forks Impellers Paper Machinery Pickling Baskets Tools, non-sparking	Trolley: Shoes Wheels Valve: Seats Stems Valves Wear Plates Worm Wheels
Silicon Bronze	Bridge Bearings Bells Impellers Paper Machinery Memorial Markers Pump Bodies	Marine Fittings Trolley: Shoes Wheels Valves Valve Stems
Silicon Brass	Bearings Gears Impellers	Rocker Arms Valve Stems
Nickel Silvers	Architectural Bearings, Turbine Dairy Equipment Fixtures Laundry Machinery Marine Fittings Milk Machinery	Ornamental Paper Machinery Railroad Fittings Typewriter Parts Valve: Discs Seats

NOTE: For specific alloys to be used with various corrosive media, and for other specific applications of copper-base alloys see Tables 33 and 34, COPPER BASE ALLOYS FOUNDRY PRACTICES.

AFS President Collins L. Carter addresses East Coast Regional Conference. At left, W. H. Baer, general chairman; behind stand, W. S. Pellini, Naval Research Laboratory; and B. N. Ames (right), Metropolitan Chapter Chairman, Doran Manganese Bronze Corp.

Foundry Economics Theme at East Coast Regional

NEARLY 500 foundrymen from the sponsoring Chesapeake, Metropolitan, and Philadelphia Chapter areas attended the AFS East Coast Regional Foundry Conference at Philadelphia, March 19-20. They participated in a two-day meeting with the theme: *Economical Foundry Operation.*

General Chairman for the Conference was W. H. Baer, Navy Dept., Washington, D. C., and also Chairman of the host Chesapeake Chapter. The Program Committee was headed by F. G. Sefing, International Nickel Co., New York. Arrangements were handled by J. M. Robb, Jr., Hickman Williams & Co., Philadelphia; Earl Gaffney, Arlington Bronze & Aluminum Co., Baltimore, Md.; and Howard Voit, Sterling Wheelbarrow Co., Hackensack, N. J. D. E. Best, Bethlehem Steel Co., Bethlehem, Pa., was Chairman of the Publicity Committee. Philadelphia Chapter Chairman W. D. Bryden, Philadelphia Bronze & Brass Co., and Metropolitan Chapter Chairman B. N. Ames, Doran Manganese Bronze Corp., Brooklyn, represented their groups in the Conference planning.

Chairman W. H. Baer opened the Conference with a welcome for attending foundrymen. He then introduced W. W. Maloney, Secretary-Treasurer, AFS, and National AFS President Collins L. Carter, who reviewed current progress of Society activities, construction of the new national headquarters building, and planning for the 1954 Convention at Cleveland.

R. J. Ely, American Brake Shoe Co., Mahwah, N. J. introduced the speaker for the first session, W. S. Pellini, Metal Processing Branch, Naval Research Laboratory, Washington, D. C. Mr. Pellini discussed the "Principles of Gating and Feeding," supplementing his remarks with a series of color slides. He emphasized the importance of directional solidification of cast metals, pointing out the critical relationship between riser-casting ratios.

Growth of Research

Research, Pellini said, has progressed tremendously in the last 10-15 years, but the field is still almost untouched. In this direction, his data have indicated that the casting itself must be designed to allow the riser to feed properly. "Feeding distance," he said, "must be built into the casting." The riser, he warned, must always consider the shape of the casting to allow sufficient freezing time.

Positioning of risers must be controlled to minimize centerline shrinkage, since the riser itself has almost no inherent feeder range. Pellini discussed the directional solidification of metal at length and its effect on shrinkage. Use of chills, he declared, will help reduce shrinkage if they are positioned between risers. Chills will also decrease the number of risers needed and will extend their general feeding range.

Pellini concluded his discussion with a review of his experiences with gun metal bronze in naval work. Strong directional solidification is necessary here for pressure tightness. Tapered chills have been used successfully, even overcoming a tendency toward gassiness. Gray and nodular iron were discussed briefly, although Pellini stated that most naval research work had been concentrated in steel and gun metal bronzes.

A panel then commented on Mr. Pellini's paper. Speaking for steel, E. H. Berry, Dodge Steel Co., referred to other forms of surface shrinkage than the centerline type resulting from inadequate feeding. Occurrence of small cracks or hot tears is another phenomenon that Berry did not think was associated with the centerline variety. He concluded with remarks about Dodge Steel's experience with chills.

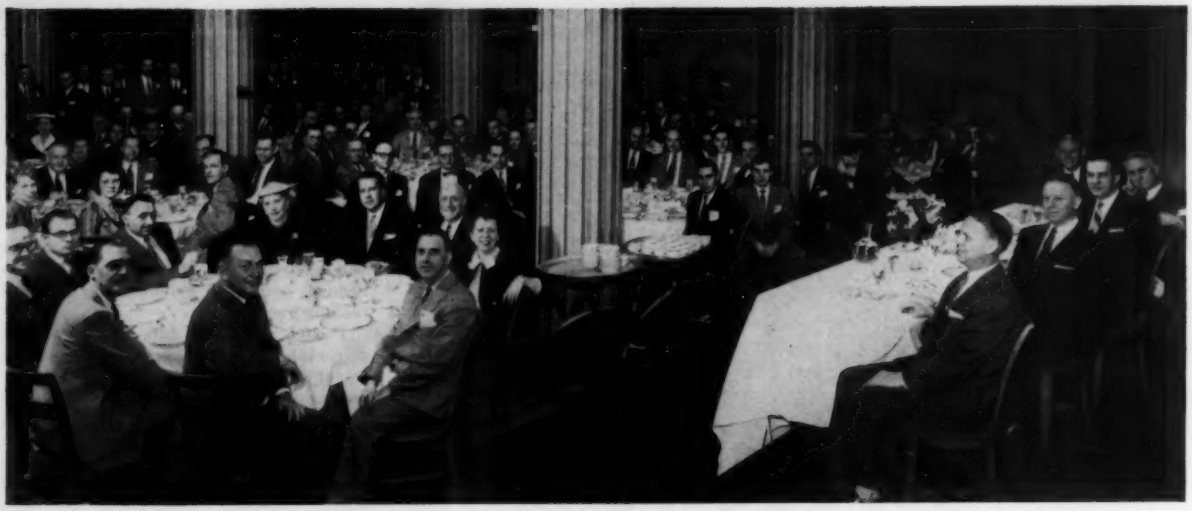
J. Fecko, Worthington Corp., replied for gray iron, and asked how much work on this alloy has been done in respect to feeding distance. Pellini replied that there is little centerline shrinkage in gray iron because of the pumping back of liquid metal resulting from pressures developed inside the casting. His laboratory is about to begin a study of gray iron and other metals.

Speaking for malleable iron foundrymen, T. M. Blank, Pennsylvania Malleable Iron Corp., asked about solidification patterns in white iron. Opinion was that in malleable iron, centerline shrinkage forms when the casting is almost solid.

E. J. Bush, Naval Gun Factory, spoke

continued on page 213

Foundrymen gathered in Philadelphia's Ben Franklin Hotel on Saturday, March 20, to paper on shell molding and panel discussion of process' significance for the industry.



Annual College-Industry banquet of Foundry Educational Foundation. Speakers' table, from left: E. M. Knapp, F.E.F. secretary-treasurer; M. J. Allen, retiring chairman of the board; J. T. Rettaliata, president, Illinois Institute of Technology; J. T. MacKenzie, retiring F.E.F. president; and E. C. Hoenicke, incoming vice-president.

Review 1953 Progress at Annual F.E.F. Meeting

Thomas Kaveny, Jr. . . . heads F.E.F.

■ Consolidation has been the theme the Foundry Educational Foundation during the past year, J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., retiring president of FEF, said in addressing the seventh annual college-industry meeting of the Foundation. Held in Cleveland, March 10 and 11, the meeting brought together some 140 engineering educators and foundrymen to participate in the annual business meeting of FEF, and to learn about current teaching methods, and about recruiting, absorption, and utilization of engineering talent.

Since May 1, 1953, Dr. MacKenzie pointed out, FEF financing has been based on regular annual contributions rather than intermittent pledges. E. M. Knapp, Ferro Machine & Foundry Co., Cleveland, FEF secretary-treasurer, stated in his report that 86 new members had joined the Foundation since May 1, 1953, and that a record $75,000 in scholarships had been made available to participating schools during the period.

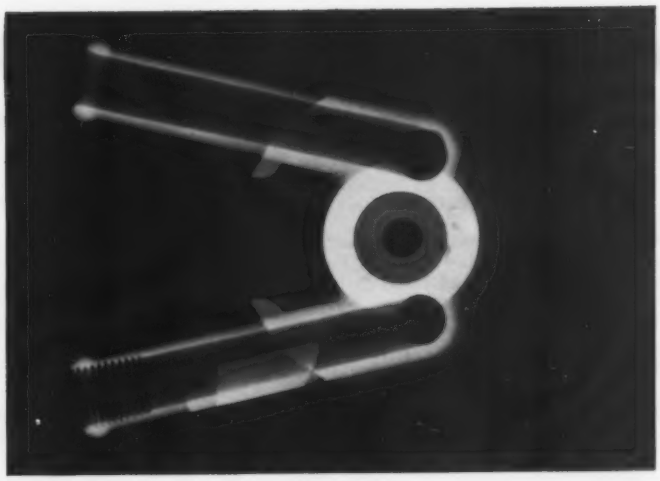
At a trustees meeting, an operating budget of essentially the same amount as last year's was approved. Officers elected for 1954-55 were: Thomas Kaveny, Jr., Herman Pneumatic Machine Co., Pittsburgh, Pa., president; E. C. Hoenicke, Eaton Mfg. Co., Detroit, vice-president; and E. M. Knapp, re-elected secretary-treasurer; E. J. Walsh was re-appointed executive director.

The annual meeting of the membership had previously voted to increase the trustees-at-large from 12 to 15 to serve overlapping three-year terms, to provide for overlapping two-year appointments of trustees by the founding members, and to eliminate the post of board chairman. New trustees-at-large elected were:

George K. Dreher, Waukesha Foundry Co., Waukesha, Wis., John B. Fleeger, Oklahoma Steel Castings Co., Tulsa, Okla., F. X. Bujold, Ford Motor Co.,

continued on page 173

Annual meeting of trustees of Foundry Educational Foundation. Clockwise from far side of table: A. M. Slichter; vice-president elect E. C. Hoenicke; C. V. Nass; board chairman M. J. Allen; W. W. Heimberger; L. A. Kleber; secretary-treasurer E. M. Knapp; executive director E. J. Walsh; Peter E. Rentschler; Stowell Wasson; C. A. Barnett; president J. T. MacKenzie; E. C. Jeter; J. M. Price; R. P. Brewer; Kennard Lange; J. E. McIntyre; F. J. Walls; C. B. Schneible; H. P. Good; J. H. Smith; and H. Charles Esgar.



More for the money?

RADIOGRAPHY SHOWED HOW

This casting was a part for an automotive heater. With a big run and a low price, profit hinged on a high yield of sound castings.

Radiographs made of pilot castings revealed a few recurring faults and indicated how a minor change in casting technics could increase the yield.

This is just one more example that shows why it pays to use radiography—one more reason you find more and more progressive suppliers of castings using it.

If you want to be known for releasing only high-quality work, if you want to improve production—look into radiography. Your x-ray dealer will be glad to show you how it can help. And, if you wish, we'll send you a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N. Y.

Radiography . . .
another important example of photography at work

Kodak

News of Technical Committees

Sand Division

Green Sand Properties Committee. This committee met at Milwaukee on February 11, 1954 with B. H. Booth, Carpenter Bros., Inc., Milwaukee, in the chair. P. H. Rosenthal, University of Wisconsin, led a discussion on the effect of mulling on sand properties, reporting on the results controlled by time and load on such properties as moisture, green strength, and permeability at various mulling times. The work had been performed in the foundry school at the University, using a synthetic sand with a 15 lb load at approximately 4 per cent moisture in an 18-in. diam muller. Rosenthal suggested that sand mulled about four minutes in each case after the moisture had been added seemed to attain optimum properties. It was agreed that the test should be run in other laboratories to permit proper evaluation and presentation as an authoritative report.

H. C. Stone, Belle City Malleable Iron Co., Racine, Wis., stated that his experience had shown that high permeability occurs at the optimum moisture content. If the same sample of sand is dried back to its original moisture content and a permeability vs. moisture curve is run, it will appear that, when drying out, the sand will have higher permeability values at all moisture contents, and will end at 0 per cent moisture with a higher permeability than shown on the original curve.

Comment was made regarding current interest in pH value of foundry sands, which might be the subject for future investigation by the committee.

Committee 8-J. This committee was scheduled to meet in a work meeting at the University of Michigan, Ann Arbor, April 6-8, and, simultaneously, at the research laboratory, Harry W. Dietert Co., Detroit. Objectives were twofold: to further development test procedures to evaluate properties of molding sand relative to the formation of scab defect; and to continue laboratory investigation on veining tendencies of cores.

The unusual program was set up for the foundry laboratory project group, meeting at Ann Arbor, to make test castings following standard procedures. The Detroit research meeting would be for the purpose of running sand tests other than the routine room temperature properties and to determine procedures and projects for the participating laboratories.

A general committee meeting was to be held at Ann Arbor on April 8 to review test castings and laboratory test data of the preceding two days. At that time, results would be evaluated and procedure for future guidance established. A full report of these sessions will appear in the June issue of AMERICAN FOUNDRYMAN.

Light Metals Division

Research Committee. Chairman W. E. Sicha, Aluminum Co. of America, Cleveland, presided at a meeting held at Battelle Memorial Institute, Columbus, Ohio, on January 28. After a financial statement on funds available for committee research, the second quarterly report from Battelle to Frankford Arsenal, covering new experimental work, was referred to briefly. Motion picture sequences illustrating important aspects of Battelle's work were shown, confirming effects of sprue design factors revealed in horizontal studies, and indicating the effect on flow rate of back pressure in vertical mold cavities.

The division round table luncheon at the Convention was discussed and it was determined that not enough new information was available to prepare a film for that meeting. It was decided to continue with research and to prepare a progress report illustrated with lantern slides for presentation at the luncheon.

New Princeton Film List

Princeton Film Center, Inc., has compiled a new list of free loan 16 mm sound films, many in full color. These motion pictures are suited for clubs, colleges, industrial, and other adult audiences. A wide range of subject matter is offered. All requests should be sent directly to Princeton Film Center, Inc., Princeton, N. J.

Publish Proceedings of A.I.M.E. Conference

The American Institute of Mining and Metallurgical Engineers has published the proceedings of its Blast Furnace, Coke Oven and Raw Materials Conference, held at Buffalo, N.Y., April 20-22, 1953.

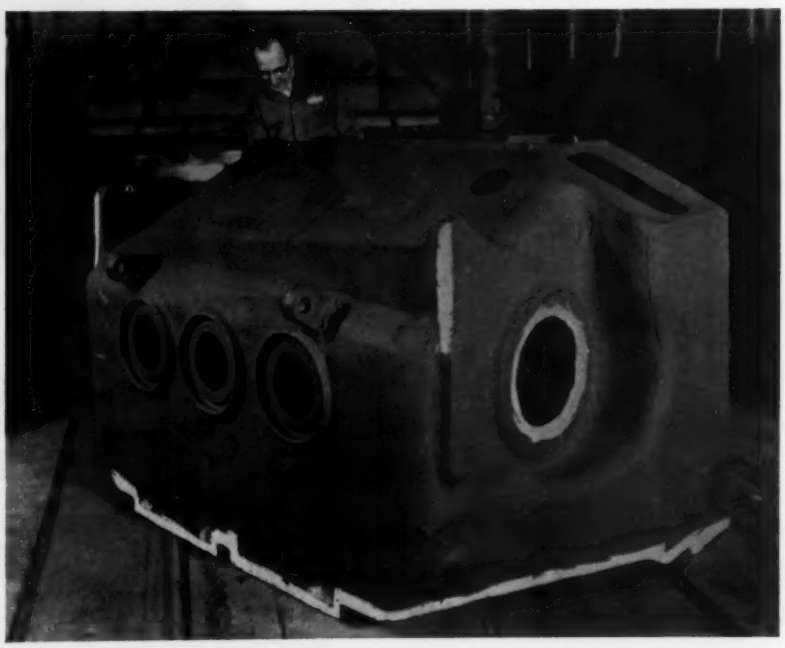
The publication comprises volume 12 of the series. It includes minutes of the meetings, abstracts, and full publication of 19 technical articles and discussions.

Business office of A.I.M.E. is located at 29 W. 39th St., New York 18.

Armour Sets Record in 1953

Armour Research Foundation of Illinois Institute of Technology, Chicago, has reported a record $10 million worth of research for industry and government during 1953.

This volume was 25 per cent over the 1952 figures and included 467 different research projects, or 70 more than for the previous year. To handle these projects, which ranged from improved automatic rocket launchers to rodent repellent for baller twine, the Foundation increased its staff to an all-time high of 1150, two-thirds of them professional engineers and scientists.



Union Steel Casting Division of Blaw-Knox Co. has been making castings for the new army M47 medium tank. Metal for hull is poured in sand mold. Ladle is filled from acid open hearth furnace. (Above) After cleaning, grinding, burning off of risers, and heat treating, bottom rear hull section of M47 is inspected.

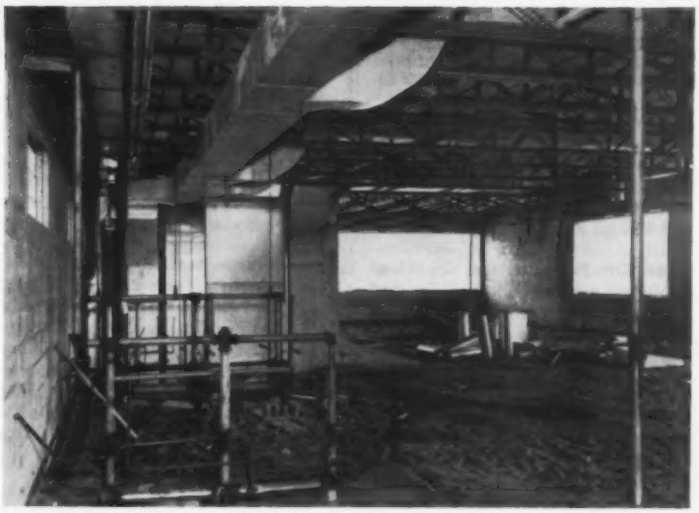
New AFS Headquarters Takes Shape

BY the end of March the new National AFS Headquarters and Foundry Technical Center at Des Plaines, Ill., had begun to take its finished form, particularly on the exterior. Installation of the roof had been fully completed, all exterior brick and stone work had been finished, and all trim and flashing installed.

Work was on schedule, although some delay had been occasioned during March by heating system installations. Laying of floor slabs was to begin by April 15, when aluminum framework in the interior was also to be set.

By the end of April, the contractor expected to finish the sidewalks and pour the blacktop for the parking lot, install interior gypsum block partitions, acoustic ceiling tiles, and begin work on hardware and door frames.

Soon after May 1, glass would be in place and interior plastering would begin. Roughing-in of heating and plumbing had been completed by mid-April and all finished plumbing was scheduled for the first weeks of May.



As spring came to Des Plaines, Ill., the AFS Headquarters and Foundry Technical Center was approaching exterior completion (above). Roughing-in of interior plumbing and heating installations had been nearly finished (below).

Indian Foundry Courses

A series of three-month courses in modern foundry practices has been under way since mid-March at the new Foundrymen's Training Centre of the Indian Institute of Technology, Kharagpur, India.

The course is being supervised by John F. Schnur of Chicago's Armour Research Foundation, who has been working in India with the Technical Cooperation Mission of the U.S. Point Four Program.

The curriculum will cover such phases of foundry practice as melting; floor snap flask, and machine molding; sand practice and testing; core making and drying; wood and metal patternmaking; fettling and shot blasting; and physical testing and inspection.

Congress Honors Scientist

A scientific congress and exhibition will be held in June, 1954 at Paris to honor the French scientist, Henry Sainte-Claire Deville, who prepared aluminum industrially for the first time in 1854.

The six-day sessions will be staged by Aluminum Française and the Societe Chimique de France. Prof. Albert Portevin of the French Academy of Sciences will be general chairman of the Congress.

Management Course Offered at Iowa

The State University of Iowa has announced its 15th Management Course, to be held June 14-26 at Iowa City. The course is an intensive one designed for factory managers, foremen, industrial engineers, methods and time-study analysts, cost accountants and office executives.

The university staff will be augmented by outstanding experts from several industries and other educational institutions. Complete information can be obtained from J. Wayne Deegan, 117 Engineering Building, State University of Iowa, Iowa City, Iowa.

Magazine Microfilmed

The 1952 issues of AMERICAN FOUNDRYMAN, comprising volumes 21-22, have been microfilmed and are available at $4.20 per set.

For full information, address University Microfilms, 313 N. First St., Ann Arbor, Mich.

Foundry Tradenews

Speedway Products, Ltd., Auckland, New Zealand, has opened a new, mechanized foundry for high production of cast iron, aluminum, bronze, and zinc-base alloys. Facilities include an overhead sand system, roll conveyors for molds, mechanical charging for cupolas, and a chemical and sand laboratory. Castings are produced in sand and permanent molds and by die casting.

International Harvester's Indianapolis motor truck engine plant has started a two-year expansion and improvement program that will result in a completely modern foundry and machine shop. Four additions will be made to present manufacturing and foundry buildings. The expansion to the foundry building will provide 14,600 sq ft additional space for improved molding and casting cooling equipment. New molding and core-making equipment, and new patterns and core boxes will be provided.

Appointment of **American Alloys Corp.,** Kansas City, Mo., as a distributor of **Reynolds** aluminum pig and ingot has been announced. American Alloys will stock aluminum pig and ingot in standard and special analysis alloys.

Forest City Foundries Co., Cleveland, has published an elaborately illustrated, 32-page brochure describing the plant facilities.

Quaker Alloy Casting Co. went into production at Myerstown, Pa., on small carbon, low alloys, stainless and high alloy castings. The company was formed by Leroy G. Miller, John W. Juppenlatz, and James J. Blauch, all formerly with Lebanon Steel Foundry.

Effective March 1, 1954, **British Electro Metallurgical Co., Ltd.,** changed its name to **Union Carbide, Ltd.,** under which name the firm will henceforth continue to manufacture and supply ferro alloys.

Detroit sales office of **Penola Oil Co.** has moved to 14300 McNichols Road, West, where the new telephone is Diamond 1-2910.

Shell Chemical Corp. has placed the world's largest epoxy resin plant in production at Houston, Texas. The plant will triple the company's supply of resins.

Joy Mfg. Co., Pittsburgh, Pa., opened a new district office at Cleveland on April 1 to provide more convenient sales and service to the industrial, construction, quarry, and metal operations in the Ohio-Michigan area.

Construction has begun in Gardena, Calif., on a factory and office building for the **Die-Casting Division, Martin-Ruegg Brass & Aluminum Foundry.** Custom molding and die casting for all types of metals will be done at the new plant.

C. I. Hayes, Inc., has begun construction of a new plant at Cranston, R. I. The new plant will have a straight-through assembly floor 80 x 340 ft in area, plus a separate laboratory for work on furnaces and atmosphere control equipment.

Basic Refractories, Inc. has been cited by the Freedom Foundation, Valley Forge, Pa., to receive the George Washington Medal for the company's 1953 advertising campaign ". . . to bring about a better understanding of the American way of life. . . ."

Caterpillar Tractor Co. employees have just completed their safest year in history, according to statistics released for 1953 by H. S. Simpson, safety manager at the Peoria, Ill. plant. In setting the new record, Peoria employees had only 2.2 lost-time accidents for every million man-hours worked, bettering the previous record low of 2.7. The metallurgical laboratory completed its 11th consecutive year without a lost-time accident.

Crucible Steel Co. of America and **National Research Corp.,** Cambridge, Mass., have joined forces to accelerate development of the vacuum melting of steels and other alloys. Crucible has acquired a 50 per cent interest in **Vacuum Metals Corp.,** formerly a wholly-owned subsidiary of National Research, and which now becomes a joint venture of the two organizations.

Rolle Mfg. Co., Lansdale, Pa., has expanded its permanent mold facilities for the production of magnesium and aluminum castings.

Rajac Equipment Sales Corp., 4718 West Touhy Ave., Lincolnwood, Ill., has been appointed sales representative for the **Whirl-Air-Flow Div., Gerwin Industries, Michigan City, Ind.**

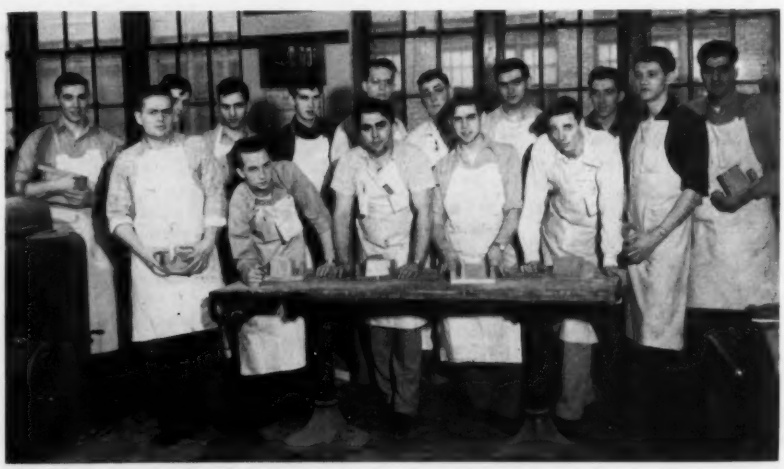
Announce Speakers For Industrial Hygiene Course

Major speakers have been announced for the symposium on instrumentation for industrial hygiene, to be held at University of Michigan, May 24-27. Dr. Philip Drinker, well-known Harvard professor and industrial and medical writer and editor, will be the principal dinner speaker.

Dr. W. G. Frederick, director, division of industrial hygiene, Detroit department of health, will be chairman of the symposium and deliver the opening address.

Other speakers who will cover various areas of industrial hygiene instrumentation are: Leslie Silverman, associate professor of industrial hygiene engineering, Harvard University; Hervey B. Elkins, division of occupational hygiene, Boston; George D. Clayton, U.S. Public Health Service; Alfred N. Setterlind, Illinois department of public health; Warren A. Cook, associate professor of industrial health, University of Michigan; Knowlton J. Caplon, industrial ventilation consultant; Charles R. Williams, Liberty Mutual Insurance Co., Boston; Karl Z. Morgan, director of health physics division, Oak Ridge National Laboratory; and Hugh Archer, Archer-Reed Co.

In addition, 19 technical papers will be presented by authorities in specific instrumentation in the various fields. Instrument manufacturers have been invited to exhibit and to act as special faculty members during the symposium.



Pictured are contestants in the wood pattern division in the 1954 AFS Apprentice Contest sponsored by the Wisconsin Chapter. ***Photo courtesy A. A. Bottoni.***

Each year gray iron foundrymen show off their best examples of jobs redesigned for production in their favorite metal through the Gray Iron Founders' Society's annual Redesign Contest. Some of last year's entries are shown here along with a final call for the 1954 competition.

Redesigning Brings Jobs Into Gray Iron Foundries

Entries in the 1953 Redesign Contest used in the national advertising program of the Gray Iron Founders' Society are shown on this page. Upper right are two 12-ft rails for an oxyacetylene cutting machine. The upper rail was formerly a two-piece assembly held together by bolts. Redesigning to permit casting in gray iron as a single piece (lower rail) eliminated two machining operations and an assembly operation. Labor and material costs have been reduced and product uniformity improved. Reduced production time has permitted schedules to be increased without added investment in production machinery.

At the lower left are before-and-after illustrations of a self-priming centrifugal pump now made with a gray iron tank. Formerly fabricated of steel (left), the tank was redesigned in modernizing the pump and as a gray iron casting is 20 per cent lower in cost, smaller, more efficient, and better looking.

The press base (lower right) was a $302 steel fabrication until redesigned for gray iron. Now it costs only $150, a 50 per cent saving, and another 15 per cent has been saved in reduced machining time. The manufacturer prefers the more attractive appearance and feels that design is an overall improvement. In writing to the foundry about the new design, the manufacturer stated: "I, for one, would be glad to explore many such conversion possibilities."

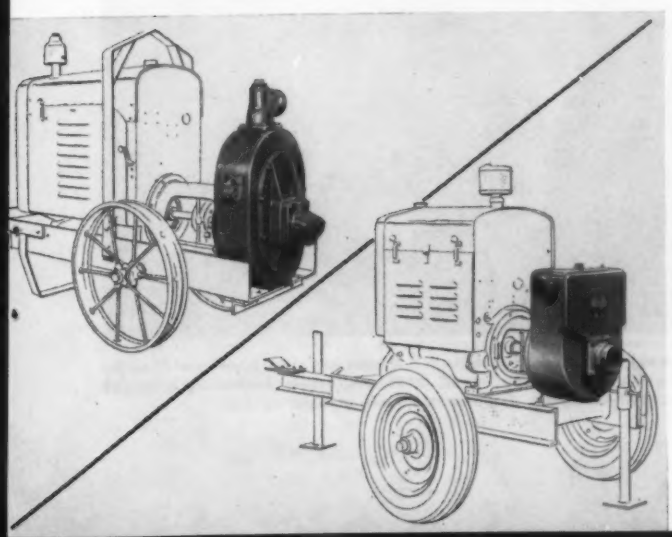
Prize winners in the 1953 contest were: 1st prize—George K. Stauffer, Reading Gray Iron Castings Co., Reading, Pa.; and 2nd prize—A. J. Hall, Hallstead Iron Foundry, Hallstead, Pa.

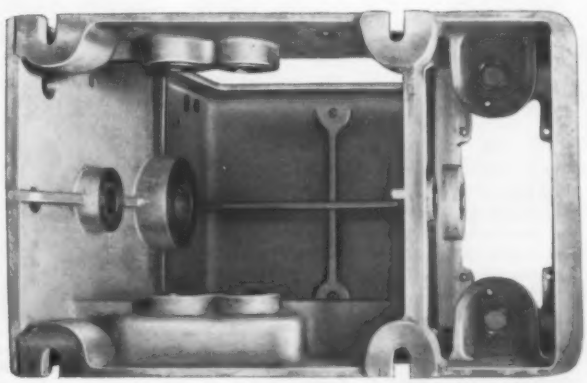
1954 Redesign Contest Still Open

This year's Redesign Contest with prizes of $500, $250, and $100, will close June 1. No advance registration or special registration form is needed, according to GIFS President Henry J. Trenkamp, Ohio Foundry Co., Cleveland, nor is membership in GIFS a requirement. The contest is open to all persons engaged in the metal working trades; entries may be made jointly by two or more individuals.

To enter the 1954 Redesigning Contest: (1) Select the best example of products or parts redesigned for production in gray iron. (2) Give the facts—savings in material and labor costs, efficiency gained, and other factors that led to the decision to change to gray iron. (3) Submit an 8 x 10-in. glossy photo of the gray iron casting, and if possible a similar photo of the original product. (4) Address entry: Redesign Contest, Gray Iron Founders' Society, Inc., National City E. 6th Bldg., Cleveland 14, Ohio. Mail in time to arrive by June 1, 1954.

Prizes will be awarded at the 26th annual meeting of GIFS at The Homestead, Hot Springs, Va., November 11-12.





Left to right, James L Leach, Asst. Prof., University of Illinois; Venkay R. Reddy, advance student, University of Illinois from Hyderbad, India; National Director C. V. Nass, Beardsley & Piper, Div. Pettibone Mulliken Corp. and Kenneth M. Smith, Caterpillar Tractor Co. at the March meeting of Central Illinois Chapter.

Dean Croxton leading the Continental Foundry & Machine Company male chorus prior to the technical meeting of the Chicago Chapter in March.

Chapter News

In the Stretch

June is just around the corner and membership in the American Foundrymen's Society as of March 31, 1954, is 11,590. This is an increase of 155 members over the previous month but still leaves 410 new members needed by June 30, 1954, to meet our target of 12,000 members. Now that we're so close to meeting the target, let's get busy and go over the top. During March four new company members have been added to the rolls. They are:

Company Members

***Aceros Ecatepec, S. A.*, Tupetlac, Mexico; Manuel de la Lama, Gen. Mgr. (Mexico City Chapter).**

***Fairbanks, Morse & Co.*, Kansas City, Kans.; Leslie G. Graper, Jr., Fdy. Supt. (Mo-Kan Chapter).**

***Parker-Stree Castings Co.*, Cleveland; Gordon A. Wiltse, Gen. Mgr. (Northeastern Ohio Chapter) Conversion from personal.**

***Southern Car & Mfg. Co., Inc.*, Birmingham, Ala.; Marion W. Dreitzler. (Birmingham District Chapter).**

Washington

The Washington Chapter held its March meeting at the Monte Christo Hotel, Everett, Wash. Guest speaker was Ray Sutter, who talked on the subject of automatic core and shell molding machines. He gave a brief discussion as to why he became interested in automatic machines and designed these units, and he proceeded to describe their use and operation. Film and slides were used in conjunction with his talk.

Wm. L. Mackey asked for a period of silence in memory of Wilbert L. Sklyes, Federated Metals Div., American Smelting & Refining Co., Seattle office, who died recently.—*Fred R. Young.*

Central New York

Central New York Chapter held its March meeting in the Roof Garden, Onondaga Hotel, Syracuse, N. Y. Chairman John A. Feola presided and 95 members were in attendance. Guest speaker was National Director Chester V. Nass, Bearsley & Piper, Div., Pettibone Mulliken Corp., Chicago. His talk covered mechanization in molding as applied to both large and small foundries and the showing of a film indicating the progressive steps in mechanization that can be employed.

At the February meeting of the chapter 90 members attended. Warner Bishop, Archer - Daniels - Midland Co., Cleveland, was guest speaker and his subject was "The 'D' Process for Shell Molding". He described the process which results in blowing a mixture containing fine dry sand and an oleo-resinous binder through a pattern mounted on the head of a core blowing machine into a contoured dryer with resultant shell baked for approximately one-half hour at temperatures from 425 F to 500 F in traditional oven.—*Bruce R. Artz.*

Western Michigan

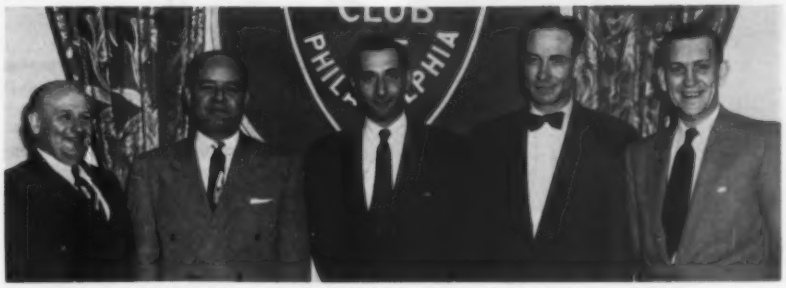
The March meeting of the Western Michigan Chapter was held at Fingers, Grand Rapids, Mich., under the direction of Chapter Chairman Fred J. DeHudy. John A. VanHaver, vice-chairman, introduced Clarence Fitz as technical chairman for the non-ferrous group. Guest speaker for this group was Ray Cochran, R. Lavin & Sons, Inc., Chicago, whose subject was "Metallurgy in Brass Foundries." In a separate room two films were shown for the ferrous group: "Techniques of the Future," by Ford Motor Co., and "Mechanization in Molding," by AFS.—*Wilson N. Hicks.*

Eastern Canada

Eastern Canada Chapter held its traditional Ladies Night Dinner Dance February 19, in the Chaplain Room of the Mount Royal Hotel, Montreal. Members, guests and their ladies in attendance totalled 330. After dinner a grand march was held. William Dunn, Western Pattern Works, was chairman of the Entertainment Committee.

J. P. Finch, right, Erie Works Foundry and director of Northwestern Pennsylvania Chapter, presenting sound slide film "Career in Metals" to H. C. Rhoads, center, supervising principal Lawrence Park School District. J. J. Finnessey, left, is senior advisor.

Speaker's table at the March meeting of the Birmingham Chapter from left to right: Robert Kattus, Coffee Speaker; Biddle W. Worthington, chapter chairman, and Clyde A. Sanders, guest speaker.



Principals of the February meeting of the Philadelphia Chapter, left to right: B. A. Miller, Crown Smelting Co.; Harold Ulrich, Sacks-Barlow Foundries; Bernie Ames, New York and Metropolitan Chapter, who gave short résumé of the forthcoming regional conference to be held in Philadelphia; Ralph White, speaker of the evening, International Nickel Co., and Bert Troy, chapter director. Photo, courtesy of Lee Houser, Dodge Steel Co.

Chapter News

Rochester

The Rochester Chapter, at its March meeting at the Hotel Seneca, was addressed by Robert A. Colton, Federated Metals Div. American Smelting & Refining Co. His subject was "Brass and Bronze Foundry Practice". Many castings, he pointed out, are lost through faulty venting; the mold cavity being filled with air becomes a gaseous matter that must be removed to have the molten metal enter and make a solid casting. It is not possible to know how much gas must be removed, he said. Mis-runs and cold shots are prevented by proper venting.—*H. G. Stellwagen.*

Birmingham District

Biddle W. Worthington, chapter chairman, presided at the March meeting of the Birmingham District Chapter held in the Tutwiler Hotel. Clyde A. Sanders, American Colloid Co., was guest speaker and his subject was "Effect of Mold Materials on Apparent Metal Shrinkage". Coffee speaker was Robert Kattus, Southern Research Institute.

In his talk, which was illustrated with slides, Mr. Sanders endeavored to show that sand and molding practice rank high on the list of causes of shrinkage and oversize castings.

Mr. Kattus, in his coffee talk, discussed the programs of the Southern Research Institute and also touched upon the activities of the Birmingham Chapter of the A.S.M. of which he is vice-chairman.—*J. A. Wickett.*

Central Michigan

R. T. Lewis, Keen Foundry Co., Griffith, Ind., was the main speaker for the March meeting of the Central Michigan Chapter at the Hart Hotel, Battle Greek, Mich. Speaking on the subject, "Are Your Foundry Costs Reliable," Mr. Lewis emphasized that up to this point consumers have been more concerned with a good source of supply than with their costs. This is rapidly coming to an end, he said. He went on to tell about cost procedures versus character of castings going through the different departments of the foundry. George Petredean was Technical Chairman for the evening.

Preceding the talk by Mr. Lewis, Ashley Sinnett, newly appointed Educational Director of AFS, spoke to the group briefly about his new position. He told the group he hopes to aid in introducing foundry courses to the Industrial Arts Curriculum in secondary high and vo-

Technical chairmen at the March meeting of the Philadelphia Chapter from left to right are: Philip Grimard, steel session; William Ball, Brass and Bronze session, and Cliff Merkert, gray iron session. Photo courtesy of Lea Houser, Dodge Steel Co.

Part of the group attending the Ladies Night affair of the Chicago Chapter at the Palmer House in February. Photo courtesy Fred Ridenour, Whiting Corp.

Some of the members and advisors of the Penn State Student Chapter. Front Row: D. C. Ekey, advisor; G. Bortle, secretary; F. Mears, chairman; L. Gruber, vice-chairman; W. P. Winter, advisor. Middle Row: John Leaman, John Hahn, Roger Yard, Leroy Yates, William Ehrhart and Donald Clark. Back Row: Kenneth Pinnow, James Bryan, Carl Beppler, Kenneth Horst, Richard Reich, Harry Nelson and Ronald Darby.

Western New York Chapter Chairman Joseph M. Clifford, left, presenting bronze plaque to Grant S. Diamond in recognition of his work as General Chairman of the First Niagara Frontier Regional Conference held in September. Presentation was made at the March Meeting. Photo courtesy of A. J. Heysel, E. J. Woodison Co.

Chapter News

Attending the joint AFS-A.S.M. Michigan State College Student Chapter February meeting, left to right; Fred Hodgson, AFS secretary-treasurer; Bruce Harding, AFS chairman; Richard Lambert, A.S.M. chairman, and guest speaker Vernon H. Patterson, Climax Molybdenum Co.

Paul Copeland, chairman of the Pattern Contest, right, presenting first place award for metal pattern to Bill Kaseta at the March meeting of the Detroit Chapter. Photo courtesy Claude B. Schneible Co.

Left to right, Burton Bevis, Caterpillar Tractor Co., Dean Van Order, Burnside Steel Foundry, and L. E. Roby, Peoria Malleable Castings Co., at the speaker's table at the February meeting of the Central Illinois Chapter.

Presentation of roses to Mrs. John Hunt, wife of Eastern Canada Chapter Chairman, by Miss Helen Choquette at the Ladies Night party held in February.

cational schools, to develop an "in-plant" training program to give laborers the opportunity of bettering themselves and to develop an "assistant to the apprentice ship" program.

Al Hensel, Educational Chairman for the group, reported that he had 58 registrants for his eight weeks' Quality Control School just concluded.—*Bob Dodge.*

Metropolitan

The March meeting of the Metropolitan Chapter was held at the Essex House, Newark, N.J. A large number of foundrymen gathered for an informal round-table discussion of the general subject of "Efficient Foundry Practices".

Discussion leaders were as follows: steel, Harlie M. Freeman; gray iron, A. J. Derrick; non-ferrous, Robert A. Colton, and technical chairman, W. T. Bourke.—*W. T. Bourke.*

Eastern New York

Jeff Westover, Westover Engineering Co., was the guest speaker at the March meeting of the Eastern New York Chapter. He discussed in some detail cost control systems and incentive plans as applied to small foundries. Three points he made in his talk were: cost control was based on the conception of pricing a job instead of metal poundage; any adequate cost system must be based on shop time, and finally, no system would work without a completely informed supervision.

At the February meeting of the group J. A. Gitzen, Delta Oil Products Co., covered the subject of baking cores from start to finish. After this general discussion he went into the subject of "High Pressure Molding" and "D" Process and made the observation that many of the supposedly new techniques being employed today were established long ago and that perhaps their growth and adaptation reflect an accelerating willingness to accept new ideas.—*S. A. Eliot.*

Central Ohio

Prior to the March meeting of the Central Ohio Chapter at the Seneca Hotel, Columbus, Ohio, the Board of

Discussing the January meeting of the Texas Chapter in Dallas, left to right: R. H. Kale, J. F. Lacey, Hiram Brown, guest speaker and G. W. Hatcher.

Directors met and discussed the membership and picnic plans. Three of the past chairmen nominated new officers for the following year.

Speaker of the evening was Lee Stark, Barrett Div., Allied Chemical and Dye Corp., who was assisted by Dallas C. Amburn of the same company. Their subject was "Shell Molding." Mr. Stark discussed the methods for determining whether it is practical for a foundry to use the shell molding method and the second part of the discussion covered the tests that could be used to determine the physical properties of resins—*Eldon Boner.*

Twin City

H. H. Wilder, Vanadium Corp. of America, Detroit, spoke on "Modern Cupola Operation" at the March meeting of the Twin City Chapter. Large dollar savings, he claimed, are possible through a thorough study of all the factors in producing metal. Toward this end, he pointed out, the foundryman should know what makes the cupola operate and how the variation of the factors concerned changes the quality of the metal. Then, all of these factors must be controlled carefully. As a suggestion, he recommended a rigid time schedule in starting and finishing the melt so that variations in procedure will readily be apparent.

N. E. Wisner of the Membership Committee announced that the membership goal set by the National Committee was 200, and during the 1953 season, the Chapter achieved a membership of 204.

Through the authority of the Foundry Educational Foundation, a $500 award was presented to the University of Minnesota for research in foundry problems. The University is well represented in the

Head table at the February meeting of the St. Louis Chapter, left to right; D. R. Moore, Prof. A. Legsdin, J. H. Culling, W. L. Kammerer, chapter chairman; A. L. Hunt, National Director; F. J. Boeneker, John O'Meara and P. E. Retzlaff.

Seated at the speaker's table at the March meeting of the Washington Chapter are from left to right: W. F. Cluff, Wm. L. Mackey, Ray Sutter, guest speaker, and W. A. Shaug. Photo courtesy Fred R. Young, C. A. Wilcox Co.

Chapter News

Chapter by Director Fulton Holtby, supervisor of foundry courses, and many graduate students.—*R. J. Mulligan.*

Central Illinois

Approximately 150 members attended the March meeting of the Central Illinois Chapter to hear National Director C. V. Nass, Beardsley & Piper, Div. Pettibone Mulliken Corp., Chicago, speak on "Mechanization of Core Making". Mr. Nass accompanied his talk with a short film of examples of highly mechanized core making.

James L. Leach, Asst. Professor, University of Illinois, introduced one of his students, Venkat R. Reddy, Advance Student from Hyderabad, India, to the membership. Technical Chairman for the evening was Kenneth M. Smith.—*J. F. Kauzlarich.*

Detroit

The Detroit Chapter held its March meeting at the Detroit Leland Hotel, Detroit. Robert W. Gardner, Mgr., Quality Control, Ford Motor Co., was guest speaker and his subject was "Quality Control in the Foundry". He illustrated his talk with slides and pointed out how quality control could be applied to small as well as large foundry operations.

Guests for the evening were boys who had entered the Local Pattern Contest. First, second and third place winners in wood patterns were: Sheldon Haglund, Allied Pattern Works; Andrew Young, Wett Laufer Pattern, and Gilbert Parkinson, City Pattern Foundry & Machine Co. Winners in metal patterns were: Bill Kaseta, City Pattern Foundry & Machine Co.; John Molnar, Peerless Pattern Co., and Wm. Piotrowski, City Pattern Foundry & Machine Co. Pattern Contest Chairman Paul Copeland and Co-Chairman Vaughan C. Reid were commended for their efforts.

In addition to the regular technical session, the Ford Motor Co. film "Techniques of Tomorrow" was shown.—*R. Grant Whitehead.*

Philadelphia

The March meeting of the Philadelphia Chapter was held at the Engineers Club, Philadelphia, and was attended by 140 members and guests. After a general discussion by Technical Chairman Bonnie Miller, the group was divided into three separate meeting rooms.

William Pellini, U.S. Naval Research Laboratory, Washington, D.C., spoke to the steel group on the "Brittle Fracture Behavior in Steels". With slides to illustrate his talk, he discussed impact testing and the reaction of various steels at various temperatures.

John Rendall, Great Lakes Carbon Corp., St. Louis, spoke to the grey iron group. His subject was "Fracture Tests—Control of Gray Iron."

The Brass and Bronze session heard Fred Riddell, H. Kramer and Co., Chicago, speak on "Fracture Tests—Control of Brass and Bronze".

The February meeting of the Philadelphia Chapter was attended by 100 persons. Main speaker was Ralph White, International Nickel Co. Inc. His subject was "Carbon Control in Basic Lined Cupola," and affiliated subjects. Technical chairman of the evening was Harold Ullrich, Sacks-Barlow Foundries, Inc.

Mr. White gave an interesting and educational lecture on the subject, which was followed by a question and answer session, moderated by the technical chairman.—*Charles R. Sweeny.*

Attending the March meeting of the Chicago Chapter from left to right: W. O. McFatridge, Robert Schauss and Walter Jaeschke. Photo courtesy Fred Ridenour, Whiting Corp.

J. Donald Locke, Long Beach Iron Works, left, and Robert Gregg, Reliance Regulator Div., American Meter Co., Inc., right, at the January meeting of the Southern California Chapter. Meeting was held at the Rodger Young Auditorium, Los Angeles, Cal.

Bob Smith, sectional chairman, left and W. M. Peterson, M. A. Bell Co., St. Louis, guest speaker, right; at the January East Texas Sectional meeting of the Texas Chapter held in Longview, Texas.

Shown at the joint University of Illinois Student Chapter meeting of AFS, A.S.M.E., and S.A.E., sponsored by American Foundrymen's Society, are left to right; Mr. Jenkins, Wagner Malleable; Ralph Buehmueller, Allis-Chalmers Mfg. Co.; Bill Messmore and Lawrence Winning, Wagner Malleable; Clyde Young, AFS student president; Charles G. Arp, Allis-Chalmers, guest speaker; Mr. Cook, past president of AFS student group; Robert Gondry, student; Prof. K. J. Trigger, U. of I.; Prof. James Leach, Faculty Adviser, and Prof. Francis, Seyfarth, U. of I.

Pete Puzzi traveled 900 miles in a straight line to attend the February meeting of the Texas Chapter held in Beaumont, Texas, and never left Texas.

Shown at the March meeting of the Southern California Chapter meeting from left to right are: Jerry Meyn, Don McLeod and Orville Wilson. Photo courtesy K. F. Sheckler, Calmo Engineering Co.

Chapter News

Texas

Approximately 75 members and guests attended the March meeting of the Texas Chapter at the Western Hills Hotel, Fort Worth, Texas. John Kane, American Air-Filter Co., Inc., Louisville, Ky., was guest speaker and his subject was "Foundries Can Be Clean, Safe and Good Neighbors". John A. Ray operated the slide projector for Mr. Kane. Various methods of collecting dust from the different operations involved in the functioning of foundries was discussed by Mr. Kane. He also covered the costs involved in the various size units and gave formulae by which one could calculate the amount of dust created in different operations and the most economical method for controlling each. —*Wm. A. Bearden.*

At the March meeting of the San Antonio Section of the Texas Chapter, held at the Alamo Iron Works, two films were shown. The film, "Outstanding Opportunities in the Foundry Industry", was furnished through the courtesy of Central Foundry Div., General Motors and "Steel Casting Design" film was through the courtesy of Steel Founders Society. Attendance at the meeting totaled 68. Refreshments following the meeting were sponsored by Kincaid-Osburn Electric Steel Co., San Antonio, Texas.—*Edw. W. Pruske.*

Southern California

The March meeting of the Southern California Chapter was held at the Rodger Young Auditorium, Los Angeles, Cal. Ray Sutter, Sutter Products Co., Detroit, was guest speaker and his subject was "Automatic Shell Molding Machines and Auxiliary Equipment". Slides and movies were shown to show how far shell molding had progressed, not only in the United States but also abroad. Some of the pictures were taken in a British foundry.

At the February meeting AFS National Director, Chester V. Nass, Beardsley and Piper, Div. Pettibone Mulliken Corp., was guest speaker. "Core Room Mechanization" was his subject, which was supplemented by a sound movie showing various degrees of core room mechanization. He pointed out even small operations can afford to mechanize core room operations.

Charles Gregg program chairman, invited everyone to attend the Sand School to be held May 19-21. The course will be conducted by F. S. Brewster, Harry W. Dietert Co.—*Otto H. Rosentreter.*

Northwestern Pennsylvania

William "Bill" Ball, R. Lavin & Co., Chicago, was guest speaker at the February meeting of the chapter. Bailey Herrington, vice-chairman, presided and acted as discussion leader. Mr. Ball stated that the responsibility of making good foundry mechanics is on the foundry foreman's shoulders and regardless of how many millions of dollars may be spent on new materials, a real job must be performed on the human aspect to make it useful. The whole fabric of our society rests on how we handle our labor and if not handled properly and good human engineering put to use, distaster will result.

Members of the chapter are wondering if Chairman Charley Gottschalk got lost in the Everglades.

The cupola practice class, Bill Peelman, teacher, had an interesting plant visitation at Pickands-Mather, Erie plant Saturday, February 13, where the making of pig iron and coke was viewed with much interest.—*Roy A. Loder.*

Chicago

Attendance at the April meeting of the Chicago Chapter, held at the Chicago Bar Association, was 197. John Rassenfoss, chapter president, presided at the dinner meeting. Following dinner, the meeting was divided into four separate groups.

H. D. Krummel, Soconey Vacuum Oil Co., was the main speaker at the maintenance division meeting and his subject was "Foundry Lubrication." Harold Reckart acted as chairman.

The foundry, as such, makes lubrication a difficult job, Mr. Krummel said. There is a tendency to take the situation, with the dust, dirt, etc., and just live with it, rather than trying to do a better job. Three factors involved in doing a better lubricating job, Mr. Krummel pointed out, are: there must be someone who has a will to do the job; a study must be made of what the lubricating job is; and storage and handling of the lubricant must be in good shape.

"Improved Methods and Lower Costs" was the theme at the malleable group meeting. Speakers were George Skupa and Delbert Sherman, International Harvester Co. Chairman and co-chairman were K. P. Smith, Chicago Malleable Castings Co., and E. E Schwantes, IHCo.

Mr. Skupa showed and described a series of examples of better production methods. One part requiring loose pieces and a special strike and strike-off technique was converted from 12 to 20 castings per mold by use of cores, and mold cost was cut to less than half. Another part was redesigned to eliminate cold cracking (by eliminating several delicate projections), to minimize grinding, and to eliminate chills. Result was a 20 per cent scrap reduction and an annual saving of $11,000.

In another example, ratio gating described in AMERICAN FOUNDRYMAN, Mr. Skupa said, provided the solution to the difficult problem of casting a long, thin complicated job. In one unusual example, he showed how metal flow was improved by putting one instead of two castings in a mold. This resulted in cutting scrap 15 per cent, saving $2,100 per year, getting higher yield and production, and greater flexibility because the smaller flask fit anywhere in the plant's production on set-up.

Skupa concluded with the recommendation that, since parts designs are becoming more complicated, foundrymen should get in on new designs at the start to avoid costly production problems and expensive changes later.

Mr. Sherman described his company's system of putting departments on a budget and placing them in competition in meeting their budget as a device for cutting costs.

At the gray iron session, S. C. Massari, Hansell Elcock Co., was the speaker and his subject was "Good Castings Cheaper." Robert Aeberly was chairman.

In the future, Mr. Massari said, all castings must be good and cheaper. There is no easy way, but only by con-

Seated from left to right at the speakers table at the March meeting of the Central Ohio Chapter are: N. H. Keyser, Ray Frank, Lee Stark, C. W. Gilchrist, Dallas C. Amburn and Fred Fuller, National Engineering Co.

H. H. Wilder, Vanadium Corp. of America, left, guest speaker at the March meeting of the Twin City Chapter, and A. W. Johnson, right, chapter vice-chairman.

Chapter News

certed effort, planning, common sense and follow through, that this can be accomplished. The answer, he said, lies in good personnel—well trained and ones having the confidence of management; good employee, management relations; and proper selection of raw materials, purchased in the most economical quantities at the lowest price and in a form making for economical handling in the plant.

Mr. Massari also discussed elimination of material waste, process control, production control, accurate estimates and cost accounting. He suggested a scrap clinic, bonus plan, cooperation with customers and good housekeeping as ways of getting good castings cheaper.

Steel, non-ferrous and pattern groups held a combined round table discussion following the general session. A. S. Grot, Edward Valves, Inc., spoke for the steel men, presenting a series of slides to illustrate the principles of designing for soundness in castings. Castings, said Mr. Grot, should be designed for the foundry, adhering to sound engineering principles, and using adequate pattern equipment. Otherwise, he warned, the foundrymen will sacrifice soundness in his product, a quality that has been difficult to achieve in the past because of lack of knowledge of casting phenomena.

Grot used the slides also to demonstrate vulnerable spots in steel castings, and to show the use of chills in extending feeder range. Other material covered directional solidification patterns and reviewed the geometry of sound casting technique. He also reviewed much of the research material developed at the Naval Research Laboratory during recent years, with considerable stress on the work of W. S. Pellini and associates.

Second panel speaker was W. L. Rudin, Elesco Smelting Corp., who represented non-ferrous foundrymen. He displayed samples of aluminum bronze castings, described feeding and gating techniques employed in their manufacture. Rudin pointed out some of the problems facing the non-ferrous industry in the use of shell molding, describing steps taken to minimize warpage of shells, and the function of holding and back-up materials in the casting process.

Patternmakers were represented on the panel by J. J. Schallerer, Calumet Pattern Works, made a strong statement regarding the function of the pattern craftsmen in the foundry industry. They have, he maintained, an integrated position in the metals casting process and must work in full cooperation with the foundry proper.

Chicago Chapter has published a Membership Directory dated February 1, 1954. Directory includes listing of current officers and directors as well as listing of past chairmen of the chapter and honorary memberships in the chapter. A history of AFS and also the Chicago Chapter and the chapter's activities are also included. Booklet also contains an alphabetical listing of membership, with company affiliation, and an alphabetical company listing. Chapter by-laws are included.

Tennessee

The Tennessee Chapter held its March meeting at the Hotel Patten, Chattanooga, Tenn. National Director C. V. Nass, Beardsley & Piper. Div. Pettibone Mulliken Corp., was guest speaker and his subject was "Core Room Mechanization."

Approximately 75 members and guests were in attendance. W. P. Delaney, chapter chairman, presided and Herman Bohr introduced the speaker. — *Fred Hetzler.*

St. Louis

The March meeting of the St. Louis Chapter was highlighted by an outstanding speaker and the awarding of the prizes for the apprenticeship contest in patternmaking and molding by Apprenticeship Chairman, Dale Arnette. Chapter Chairman, Webb Kammerer, presided. Entertainment Chairman John O'Meara, announced final plans for the Spring Dinner Dance to be held in May at Norwood Hills Country Club.

Ralph M. Hill, technical chairman, introduced the guest speaker, Clyde L. Schwyhart, Caterpillar Tractor Co., Peoria, Ill., who spoke on "Industrial Training Values." Mr. Schwyhart discussed the importance of training and how it passes on to each succeeding generation the benefits of the experience of the preceding generation. The old philosophy that a man must work to survive, does not hold true any more, he pointed out, and therefore, industry must sell itself to the worker if it is to get the help it requires. — *J. R. Bodin, Jr.*

Central Indiana

Mechanization in the foundry, was the topic for members of the Central Indiana Chapter, at the March meeting held at the Athenaeum in Indianapolis. Technical Chairman, S. F. Swain, Golden Foundry, Columbus, Ind. and Chapter Chairman, Dallas Lunsford, Perfect Circle Corp., presided.

Among the guests of this meeting

J. W. Costello, American Hoist & Derrick, St. Paul, Minn., left; Otto Harer, Scientific Products Co., Chicago, center, and O. Jay Myers, chapter chairman, at the February meeting of the Twin City Chapter. Mr. Harer was guest speaker.

Jeff Westover, Westover Engineering Co., guest speaker, left, and Bill Stevenson, vice-chairman of the Eastern New York Chapter at the March meeting.

William "Bill" Ball, R. Lavin & Co., Chicago, guest speaker at the Feburary meeting of the Northwestern Pennsylvania Chapter.

Hubert Chappie, National Supply Co., Chairman of the Southern California Chapter at the January meeting.

New officers and directors installed at the March meeting of the Mexico City Chapter are left to right: Fco. Diaz Covarrubias, director; Frank Madrigal, outgoing chairman; Luis Delgado-Vega, secretary-treasurer; Carlos Tuffinder, director; Urbano Lopez Ayala, vice-chairman; Ingo F. Gonzales, director; Sr. Enrigue Varela, director, and Sr. Juan Latapi Sarre, director.

Chapter News

was Bill Maloney, National Secretary-Treasurer of AFS. Mr. Maloney had attended an earlier meeting of foundry managers sponsored by the Central Indiana Chapter. He addressed the members, commenting on the value of membership and complimented our chapter on the better than excellent record.

Guest speaker, Russell J. Geitmann, Link-Belt Co. was then introduced by Mr. Swain. Mr. Geitmann's complete talk on mechanization was illustrated with a series of slides covering every phase of the foundry industry. Mechanization should be accomplished, Mr. Geitmann said, without undue production curtailment. To do this, need must first be determined, then procedure outlined and planned, and finally installation with least interruption following your plan.—*William H. Faust.*

Mexico City

New members of the Managing Committee of the Mexico City Chapter were installed at the March meeting. A film entitled, "Making Large Castings in a Small Foundry" was exhibited by Ing. Fuchs of Fundicion Pan-Americana. An interesting talk was given by Ing. Francisco Diaz. Covarrubias entitled "Experiences in American Foundries" in which he talked of what he saw during the time he was in the United States under the Point 4 Program.

Attending the meeting were Ing. Pedro C. Torres of International Harvester of Mexico from Saltillo, Coah.; Sr. Carlos Taffinder of Fabricacion de Maquinas of Monterey, N. L., and Ing. Urbano Lopez Ayala of Fundicion El Rosario from Puebla, Pue. — *N. S. Covacevich.*

Northeastern Ohio

More than 200 persons attended the March 11 National Officers Night meeting of the Northeastern Ohio Chapter, held at the Tudor Arms Hotel, Cleveland. Stephen E. Kelly, Eberhard Mfg. Co., chapter chairman, presided.

Special guests included Dr. J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, National Director of AFS and president of the Foundry Educational Foundation; William W. Maloney, AFS Secretary-treasurer and Hans J. Heine, AFS Technical Director.

Dr. MacKenzie spoke briefly and extended a welcome and greetings from the AFS, F.E.F. and the Birmingham Chapter. Mr. Maloney reported on the program of the AFS headquarters building and expected its occupancy in late July or early August. Mr. Heine previewed briefly the technical program for the national foundry convention and gave an indication of the subject matter of some of the technical papers, panels, round tables and shop courses.

Speaker at the general session was Robert H. Zoller, Zoller Casting Co., Bettsville, Ohio, who described his company's experiences and the techniques developed for the operation and use of a basic-lined, water cooled cupola which requires the bottom to be dropped only once a week. Prof. Charles F. Walton, Case Institute of Technology, was the general session chairman.

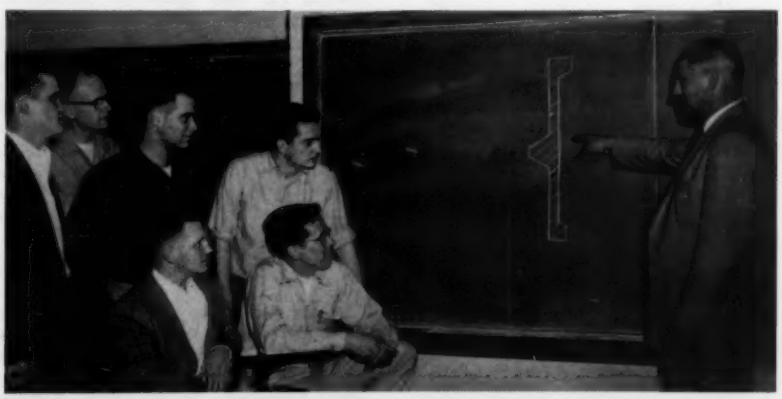
Approximately 40 members of the chapter's patternmaking division gather in separate session to hear M. K. Young, U. S. Gypsum Co., present a paper on "Hydrocal Pattern Making." Mr. Young described the latest types of plaster available, types with characteristics which greatly increase the utility of plaster as a pattern material. They do not set too speedily, expand upon hardening, are very hard when dry and can be prepared to compensate for shrinkage allowance. They are particularly useful for making large patterns for short-run production for which wood or metal patterns would be too expensive, but they also have applications for patterns for plastic coreboxes, matchplates, stretchplates for stretching aluminum and for other purposes. John Roth, Cleveland Standard Pattern Works, was chairman of the session.—*Kenneth L. Mountain and Jack C. Miske.*

Ontario

The regular monthly meeting of the Ontario Chapter was held at the General Brock Hotel in Niagara Falls on March 26th. Plant visits by the members were made through the kindness of the Carborundum Co. of Canada and Canadian Furnaces.

L. "Bern" Morris of Standard Sanitary and Dominion Radiator Ltd., introduced the speaker of the evening, Mr. H. Mabson, Chief Inspector of the Industrial Accident Prevention Association. Mr. Mabson's talk was titled "How Health and Hygiene Affect Foundry Costs." After pointing out that the humanitarian aspect of safety is most praiseworthy, Mr. Mabson went on to show that the economic angle is well worth serious consideration.

Based on the 1952 records of the Workmen's Compensation Board of Ontario (1953 records are not completed) Mr. Mabson pointed out that there were 1,425 claims of 5 days or more in that year, and that the average lost time was 27.9 days for temporary disabilities and 193.2 days for permanent cases. These figures do not in-



Stephen Pasick, district Manager, Sterling Wheelbarrow Co. recently appeared before a group of foundry students at Michigan State College and discussed "Foundry Flask Design." He is shown at the right, above, explaining the important aspects of a flask section design. Pictures of many special flasks that are in use in job and production foundries throughout the country were also shown.

clude pneumoconiosis cases. Obviously, the time lost from these cases in Ontario alone is alarming.

Even more alarming is the amount of money involved, as well as the lost production value. In 1952 the amount involved for medical attention alone was in excess of $121,000.00, whereas the total cost was more than $450,000.00 including administration costs of approximately 12 per cent. This amount is for the foundry industry alone.

What does this mean in volume of business? In Ontario, costs of Workmen's Compensation is paid for by all industry, pro-rated as to severity and risk, and these costs must be met before profits may be realized. Using 5% as an arbitrary profit margin, it means that before one cent of profits are realized the foundry industry of Ontario must do more than $8,000,000.00 worth of business.

Obviously, safety in the Foundry Industry is "big-money." Whatever type of safety campaign is initiated it will be beneficial. However, such a drive is just like a fire, as soon as you stop feeding it, it starts to go out. Safety must be pushed, and pushed hard every day in every way.

Pneumoconiosis, a general term covering silicosis and other lung diseases started by inhaling foreign bodies. Is compensable in Ontario, and whether you call it silicosis or not it is definitely related to dust hazards. As we are aware dust hazards are present in foundry operations. Proper and adequate ventilation can control these hazards but unfortunately most attempts have not been carried far enough. This is Management's responsibility, and it behooves them to study the problem carefully.

Mentioning other aspects of Foundry Safety Mr. Mabson recommended the Outline of Fundamentals of Foundry Safety, published by the AFS in 1952-53, as the best source of specific information.

He closed his remarks by emphasizing the need for teaching safe practices to all employees new and old, and cautioned against older employees becoming careless through constant associations with the dangers of their occupations.—*Wm. H. L. Bryce*

Complimenting speaker after his talk on Mechanization in the Foundry at the March meeting of the Central Indiana Chapter are left to right: W. W. Maloney, AFS Secretary-Treasurer; Dallas Lunsford, Chapter Chairman; Russell J. Geitmann, guest speaker, and S. F. Swain, Technical Chairman.

Student Chapter Directory

The following officers and advisors have been announced for the Student Chapters:

University of Alabama

Chairman, Sinclair S. Latham; *vice-chairman,* Lewis M. Jessup; *secretary-treasurer,* Dewey E. Myers; *industrial advisor,* L. N. Shannon, Stockham Valves & Fittings Co., and *faculty advisor,* Warren C. Jeffery, Asst Prof., Dept. of Metallurgical Engineering, University of Alabama.

Brooklyn Polytechnic Institute

Chairman, Richard Casagrande; *vice-chairman,* Frank A. Kimpel; *secretary,* Biagio A. Spinelli; *treasurer,* John S. Neesham, Jr.; *industrial advisor,* Charles Preusch, Crucible Steel Co. of America Spaulding Plant, and *faculty advisor,* William H. Ruten, Polytechnic Institute of Brooklyn.

University of Illinois

Chairman, Clyde Young; *vice-chairman,* Robert Gondry; *treasurer,* John Bond; *acting secretary,* Richard Wharton; *engineer council,* W. W. Smith; *industrial advisors,* J. Shellaberger, Wagner Malleable Iron Co., and A. V. Martens, Pekin Foundry Co.; *faculty advisor,* James L. Leach, Assoc. Prof., Mechanical Engineering Dept., University of Illinois.

Massachusetts Inst. of Technology

Chairman, Russell A. Chihoski; *vice-chairman,* Malcom T. Hepworth; *technical secretary,* Sheldon Moll; *treasurer,* Bernard Klim; *industrial advisor,* Walter M. Saunders, and *faculty advisor,* Prof. Howard F. Taylor, Massachusetts Institute of Technology.

Michigan State College

Chairman, Bruce Harding; *vice-chairman,* Claridon J. Thomas; *secretary-treasurer,* Frederick J. Hodgson; *corresponding secretary,* Thomas Thomas; *industrial advisors,* R. Verne Righter, Saginaw Malleable Iron Co., Div. General Motors Corp., and Albert E. Rhoads, Engineering Castings Corp.; *faculty advisors,* Dr. A. J. Smith, alternate advisor head, Metallurgical Engineering Dept., Michigan State College and Prof. C. C. Sigerfoos, Mechanical Engineering Dept., Michigan State College.

University of Michigan

Chairman, Paul Trojan; *vice-chairman,* John Vennerholm; *secretary,* George Hilsabeck; *treasurer,* Kenneth King; *industrial advisor,* Kenneth F. Packer, and *faculty advisor,* R. A. Flinn, Chemical & Met. Dept., University of Michigan.

Attending the March meeting of the Mexico City Chapter are left to right: Luis Delgado-Vega, chapter secretary; Frank Madrigal, retiring chairman, and Fco. Diaz Covarrubias.

Chapter News

University of Missouri School of Mines and Metallurgy

Chairman, Ralph Hollocher; *vice-chairman,* Dan Groteke; *program chairman,* Robert D. Tellefsen; *secretary-treasurer,* James Hubeli; *membership chairman,* Tony Selvaggi; *reporter,* Bob Skaggs; *industrial advisor,* A. L. Hunt, National Bearing Div., American Brake Shoe Co., and *faculty advisor,* D. S. Eppelsheimer, Prof., Dept. of Metallurgical Engineering, School of Mines and Metallurgy.

Ohio State University

Chairman, Richard H. Buchsieb; *vice-chairman,* Herbert Hunt, Jr.; *secretary,* Ronald C. Martins; *treasurer,* Rolland K. Lenhart, and *faculty advisor,* Dr. Douglas C. Williams, Dept. of Ind. Engr., Ohio State University.

Oregon State College

Chairman, Charles R. Utterback; *vice-chairman,* Roland Valitchaka; *secretary,* Edwin B. Gillispie; *treasurer,* Kenneth R. Lyttle, and *faculty advisor,* James W. Smith, Instr., Industrial Engineering Dept., Oregon State College.

Pennsylvania State College

Chairman, Francis C. Mears; *vice-chairman,* Leon L. Gruber; *recording secretary,* George R. D. Bortle; *corresponding secretary,* Richard L. Dennis; *treasurer,* Paul J. Saltis; *industrial advisor,* T. C. Jester, Darling Valve & Mfg. Co., and *faculty advisors,* W. P. Winter and D. C. Ekey, Instructors, Penn State College.

Texas A & M College

Chairman, John Mitchell; *vice-chairman,* Denny L. Smith; *secretary,* Larry Ingram; *treasurer,* Dennis R. Lucas; *publicity director,* Carl C. Livesay; *industrial advisor,* Herman Roberts, Oil City Iron Works.

University of Wisconsin

Chairman, James H. Dance, Jr.; *vice-chairman,* Carl R. Loper, Jr.; *secretary-treasurer,* James H. Davies; *industrial advisor,* Thomas Tanner, and *faculty advisor* Richard W. Heine.

Other Organizations

Reading Foundrymen's Assoc.

John F. Miller, Stanley G. Flagg Co., Pottstown, Pa., addressed the Reading Foundrymen's Association in the Walnut Room of the Berkshire Hotel at the March meeting. Twenty-one vocational guidance instructors from the Berks County high schools and colleges were at this special safety meeting.

Mr. Miller stated that the first and most important ingredient for a successful safety program in a foundry is the enthusiastic endorsement and continuing support of top management. In addition to this, top management should provide the necessary physical needs for a good safety program such as goggles and other safety devices necessary for the job, as well as an adequate first-aid station with trained personnel in charge. According to Mr. Miller, the foundries with a reputation for safe working conditions and good housekeeping will always attract the more desirable employees.

President James Woodward presided at the business session and appointed the following Nominating Committee: Bruce W. Edris, Arlan L. Wentzel and Hermann P. Good, Chairman. Anthony S. Rogers, Stanley G. Fagg Co., served as moderator and technical chairman.

Round table discussions were held at the February meeting. President James Woodward, Excelsior Brass Works, presided at the dinner preceding the discussions at which 78 attended.

Following the dinner, Walter R. Jaeschke, Whiting Corp., moderator of the iron group, showed slides and a film on various phases of foundry work.

The other two groups, brass and bronze, headed by Raymond Cochran, R. Lavin & Sons, and steel, moderated by J. J. Blauch, Quaker Alloyed Casting Co., adjourned to separate rooms to hold their discussions.—*William I. Cassidy.*

Connecticut Non-Ferrous

The January meeting of the Connecticut Non-Ferrous Foundrymen's Association was held at the Garde Hotel, New Haven, Conn. Bernard Meredith, Federated Metals Div., American Smelting & Refining Co., was guest speaker and his subject was "Aluminum Casting Defects."

The principal defect in casting aluminum is porosity of either the gas or shrinkage type, it was pointed out. Gas porosity is by far the more common and can usually be distinguished from the shrinkage type by its fairly even distribution and the roundness and smoothness of the voids. Improper temperature control, during melting, Mr. Meredith said, is the usual cause of gassy metal.—*John V. McCarthy.*

Metropolitan Brass Founders'

Members of the Metropolitan Brass Founders' Association elected officers for 1954 at the January meeting of the organization.

Officers elected were: president, Jack Friedman; vice-president, Raymond Bietry; secretary-treasurer, John C. Spring, and labor relations committee chairman, Jack Friedman.—*George Staub.*

New England Foundrymen's Assoc.

The following officers were installed at the January meeting of the New England Foundryman's Association: president, Henry G. Stenberg; vice-president, Howard B. Nye, and secretary-treasurer, Thomas I. Curtin, Jr.

Speaker of the evening was Dr. C. M. Adams, Asst. Professor of Metallurgy, Massachusetts Institute of Technology, who spoke of the production of high strength cast aluminum. A question period followed his talk.—*Alexander Beck.*

Obituaries

Ralph Ditty, 77, died in Lakeside Hospital March 16. For more than 30 years he was president of the Federal Foundry Supply Co. Cleveland. In 1907 Mr. Ditty was one of the organizers of the foundry supply company he headed. Since the early 1920's he has been its president and its executive management head.

Wilbert L. Skyles, Federated Metals Div., American Smelting & Refining Co., Seattle office, died recently.

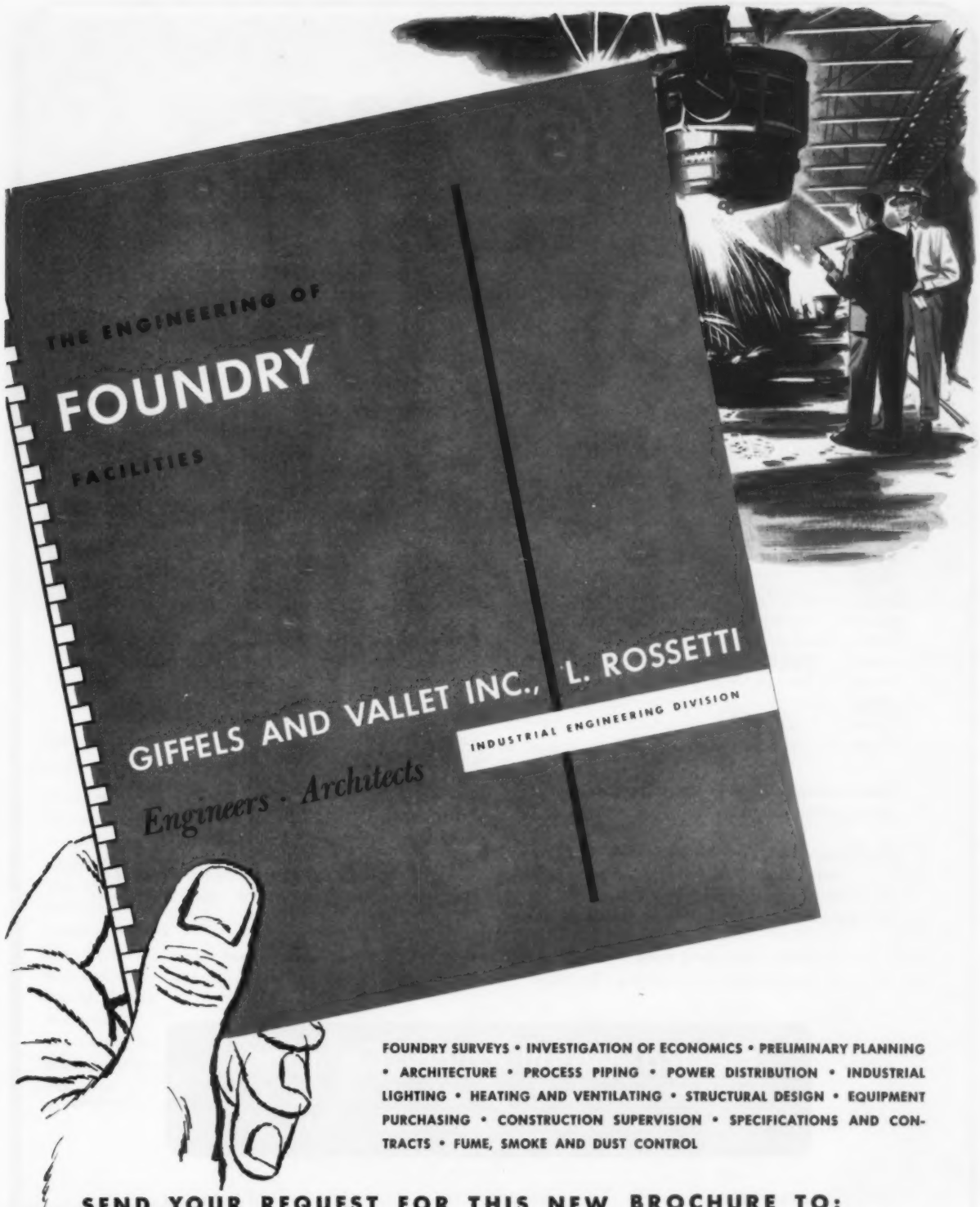
Dr. C. C. Wright, Fuel Technology Div. Chief, Pennsylvania State University, died suddenly from a heart attack in February. Dr. Wright first came to Penn State in 1932 as the recipient of a National Research Council Fellowship in chemistry to study the Hydrogenation of coal. He held the following positions in Fuel Technology: research assistant 1934-36; associate professor 1936-42; professor 1942-45; and division chief since 1945.

E. T. Wilson, Jr., 48, sales representative of the Tubular Products Div., Babcock & Wilson Co., died recently. Prior to joining Babcock he was purchasing agent for the Cascade Mfg. Co. an affiliate of Electric Steel Foundry and the Hyster Co.

John J. McDevitt, 75, Milwaukee area sales representative of the S. Obermayer Co. for more than 50 years, died in February in the Veterans Hospital, Wood, Wis. He had been ill about six months. In 1943 Mr. McDevitt was honored by AFS for his service to the industry for over 50 years. He received a plaque in recognition of these services.

Frank E. Moore, 76, Chairman of the Board, Mathews Conveyor Co., died at his home in Ellwood City, Penn., in February. He joined the Mathews Gravity Carrier Co., St. Paul, Minn., shortly after the company was founded in 1905 and brought the company, now Mathews Conveyor Co. to Ellwood City in 1912, where he served as its president until 1948, when he became Chairman of the Board of Directors.

Norman F. S. Russell, Chairman of the Board of United States Pipe and Foundry Co., died at his home in Edgewater Park, N. J., in February. He came with U. S. Pipe as a sales trainee in the Scottdale Plant in 1910. In 1922, he was elected vice-president; president in 1923, and Chairman of the Board in 1948.



FOUNDRY SURVEYS • INVESTIGATION OF ECONOMICS • PRELIMINARY PLANNING • ARCHITECTURE • PROCESS PIPING • POWER DISTRIBUTION • INDUSTRIAL LIGHTING • HEATING AND VENTILATING • STRUCTURAL DESIGN • EQUIPMENT PURCHASING • CONSTRUCTION SUPERVISION • SPECIFICATIONS AND CONTRACTS • FUME, SMOKE AND DUST CONTROL

SEND YOUR REQUEST FOR THIS NEW BROCHURE TO:

GIFFELS & VALLET INC.
INDUSTRIAL ENGINEERING DIVISION
1000 MARQUETTE BUILDING • DETROIT, MICHIGAN

ELECTROMET

Trade-Mark

ALLOYS

"Quality Plus Service"

Boron . . Ferroboron (in minimum 10.00% and 17.50% Boron grades), Manganese-Boron, Nickel-Boron and Boron Carbide.

Calcium . . Calcium-Silicon, Calcium-Manganese-Silicon, and Calcium Metal.

Chromium . . "Simplex" Low-Carbon Ferrochrome (0.010% and 0.025% maximum Carbon), Low-Carbon Ferrochrome (from 0.03% to 2.00% maximum Carbon), Nitrogen-Bearing Low-Carbon Ferrochrome, High-Carbon Ferrochrome, Exothermic Ferrochrome, Exothermic Silicon - Chrome, "EM" Ferrochrome - Silicon, "EM" Ferrosilicon-Chrome, "SM" Ferrochrome, Foundry Ferrochrome, Electrolytic Chromium Metal, and other Chromium Alloys.

Columbium . . Ferrocolumbium and Ferrotantalum-Columbium.

Manganese . . Standard Ferromanganese, Low- and Medium-Carbon Ferromanganese, Low-Iron Ferromanganese, "Mansiloy" Alloy, Manganese Metal, and other Manganese Alloys.

Silicomanganese . . In maximum 1.50%, 2.00%, and 3.00% carbon grades.

Silicon . . Ferrosilicon in all grades, including both regular and low-aluminum material, Silicon Metal, "SMZ" Alloy, Magnesium Ferrosilicon, and other Silicon Alloys.

Titanium . . Low-Carbon Ferrotitanium, Silicon-Titanium, and Manganese-Nickel-Titanium.

Tungsten . . Ferrotungsten, Tungsten Powder, Calcium Tungstate, and Calcium Tungstate Nuggets.

Vanadium . . Ferrovanadium in all grades, Vanadium Oxide (Fused), Sodium Polyvanadate (Red Cake), and Ammonium Metavanadate.

Zirconium . . 12 to 15% and 35 to 40% Zirconium Alloys, and Nickel-Zirconium.

"EM" Briquets . . Silicon, Silicomanganese, Ferromanganese, Chromium, and Zirconium Briquets.

Information about these and other alloys and metals produced by ELECTROMET is contained in our new catalog "ELECTROMET Ferro-Alloys and Metals." Write for a copy.

Electro Metallurgical Company

A Division of Union Carbide and Carbon Corporation

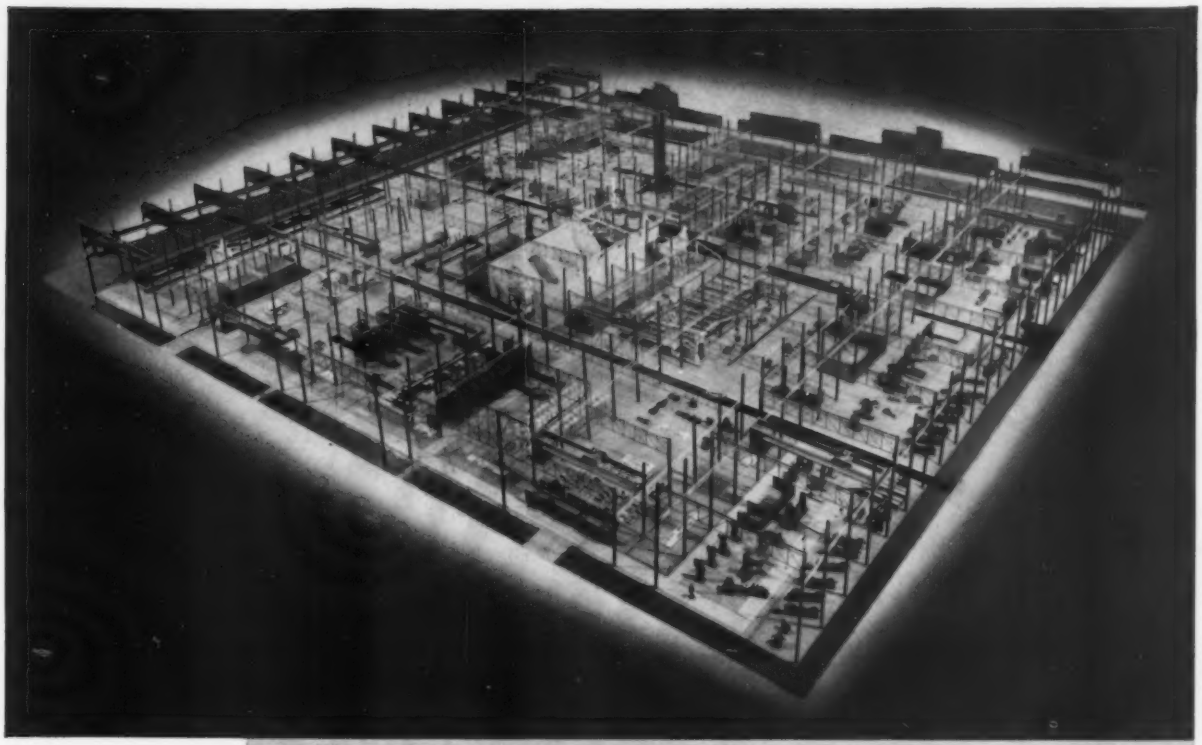
30 East 42nd Street UCC New York 17, N. Y.

OFFICES:
Birmingham • Chicago • Cleveland Detroit • Houston • Los Angeles • New York • Pittsburgh • San Francisco

WAREHOUSES:
Chicago • Los Angeles • Oakland, Calif. • Portland, Ore. • Sheffield, Ala.

IN CANADA:
Electro Metallurgical Company, Division of Union Carbide Canada Limited, Welland, Ontario

"Electromet," "EM," "Mansiloy," "Simplex," "SM," and "SMZ," are trade-marks of Union Carbide and Carbon Corporation.



SWISS FOUNDRY MAINTAINS WORLD COMPETITIVE POSITION BY USING AMERICAN PRODUCTION PRINCIPLES

Knight Services Include:

- Foundry Engineering Management
- Organization
- Industrial Engineering
- Wage Incentives
- Cost Control
- Production Control
- Modernization
- Mechanization
- Materials Handling
- Automation
- Survey of Facilities
- Architectural Engineering
- Construction Management

Pictured above is a 3-dimensional model (by Knight Models, Inc.) of the proposed new foundries, forge, and machine shops for Sulzer Bros., Ltd., Winterthur, Switzerland. Sulzer Bros. is Switzerland's oldest manufacturer of diesel engines, pumps, refrigerators, and general machinery.

Knight Engineers made a study of Sulzer's 5 foundries and developed methods, rigging, and facilities to produce grey iron castings to 30 tons and steel castings to 10 tons—with a reduction in labor and material costs of approximately 35%. Foundry facilities also were developed for piston rings, light automotive castings, nonferrous castings, and precision castings with substantially lower production costs.

Visit our booth No. 1527 at the AFS Convention in Cleveland. See this model and discuss the possibilities of modernizing and mechanizing your foundry operations.

EVIDENCE OF EXPERIENCE

Lester B. Knight & Associates, Inc.

Consulting Engineers

MEMBER OF THE ASSOCIATION OF CONSULTING MANAGEMENT ENGINEERS, INC

600 W. Jackson Blvd., Chicago 6

917 Fifteenth St., N. W., Washington 5, D. C. • Lester B. Knight & Associates, 50 Church St., New York 7

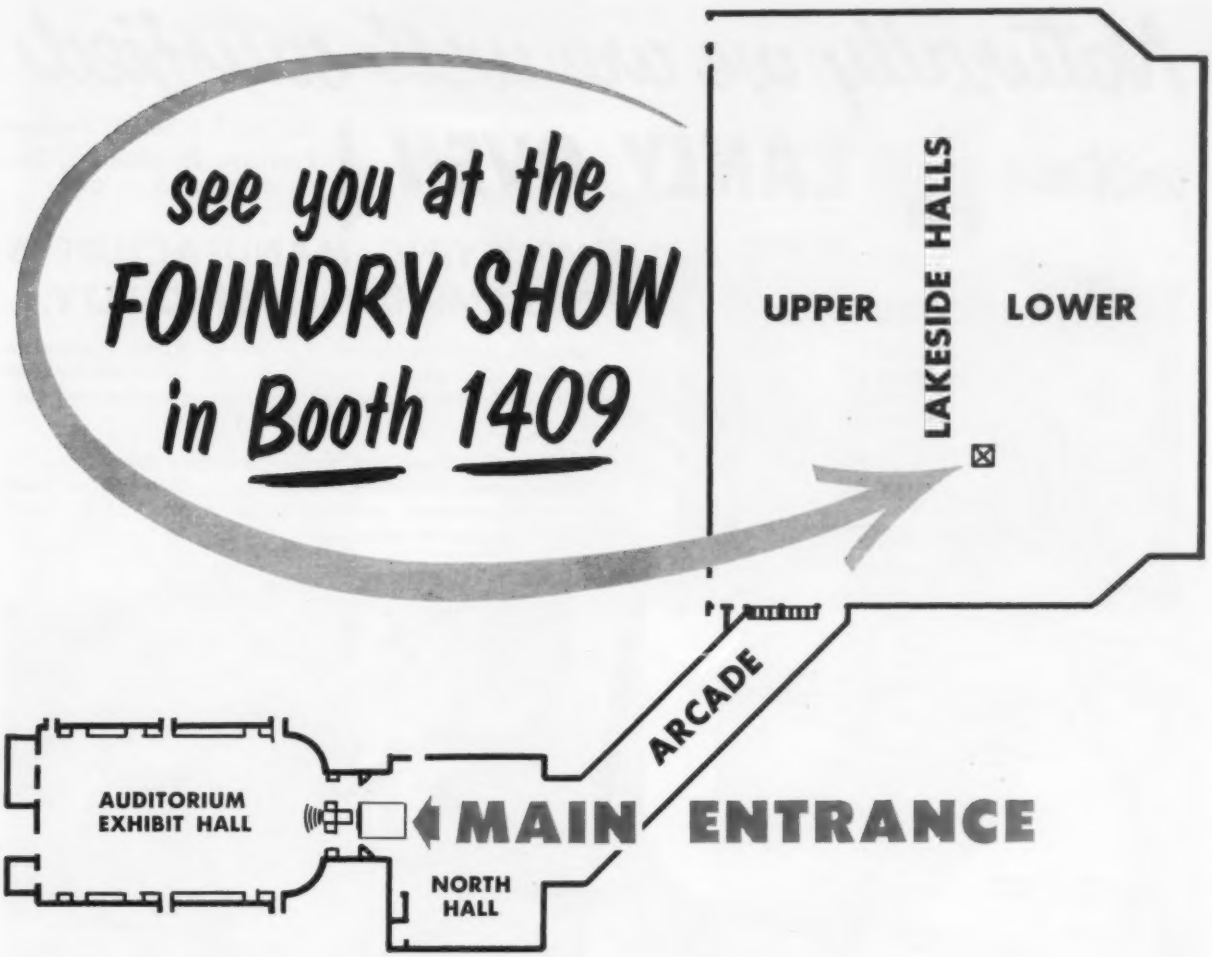
BE SAFE WITH SiPi QUALITY
BE SAFE WITH SiPi SERVICE
SiPi METALS CORP.
PRIME PRODUCER OF NON-FERROUS ALLOYS
Visit with us at the AFS FOUNDRY SHOW Cleveland - May 8-14 Booth - 1353
COMPLETE WAREHOUSE Stocks in CHICAGO CINCINNATI DETROIT PITTSBURGH for fastest delivery

SiPi METALS CORP. 1720 ELSTON AVE., CHICAGO 22, ILLINOIS

Sales offices in Cincinnati, Detroit, Indianapolis, Milwaukee, Pittsburgh

BRASS • BRONZE • ALUMINUM • LEAD • TIN • SOLDER • SHOT ALLOYS • ANODES • BABBITT • ZINC BASE ALLOYS • NICKEL ALLOYS

see you at the FOUNDRY SHOW in Booth 1409

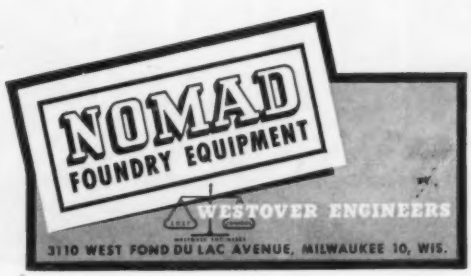


WESTOVER ENGINEERS are proud to participate in the most important event of the year for Foundrymen—the Foundry Show for 1954.

We'll be waiting in booth 1409 located on the lower level of Lakeside Hall to show you our line of Nomad Foundry Equipment.

If you have a layout problem ***bring your drawings or blueprints with you.*** Our foundry engineers will be on hand to offer suggestions and advice.

Why not insure your trip to the foundry show by planning to spend some of your time with us finding out how Nomad Foundry Equipment can improve your foundry's efficiency, reduce your costs and increase your sales.



WESTOVER ENGINEERS
NOMAD FOUNDRY EQUIPMENT DIVISION
3110 W. FOND DU LAC AVE. • MILWAUKEE 10, WISCONSIN

Naturally we are well satisfied with our LANLY OVEN

says Mr. R. R. MILLER, *President*
Precision Metalsmiths, Inc.
CLEVELAND 17, OHIO

SIMPLIFYING MANUFACTURERS PROBLEMS is their SPECIALTY...

Supplying precision castings of single components or complete assemblies . . . ranging in weight from a fraction of an ounce to over several pounds in unlimited quantities of ferrous and non-ferrous alloys.

Just a few of these "cast masterpieces" are shown here. As Mr. Miller states, his LANLY OVEN is responsible in no small way for the consistent, excellent results obtained on a "round the clock" production schedule.

Precision Metalsmiths, Inc.
PRECISION INVESTMENT CASTINGS • FERROUS & NON-FERROUS
CONSULTATION • RESEARCH • DEVELOPMENT
1621 East 260th Street • Cleveland 17, Ohio
Telephone: IVanhoe 1-4900

February 23, 1954.

The Lanly Co.
750 Prospect Avenue,
Cleveland 15, Ohio.

Gentlemen:

We thought you might be interested in receiving our comments on the Lanly Mold Curing and Wax Reclaiming oven purchased from you in February, 1952.

This oven is certainly well engineered as it has been in constant operation from the date of installation without any down-time due to failures of any nature.

We maintain a 210° temperature for curing invested molds. These molds have considerable water and wax in them. Between 6-8 hours is required for curing.

Previously in another type of oven it took between 24-30 hours for the same operation.

In short, we have had uninterrupted performance on a 24 hour production basis from our Lanly and naturally are well satisfied.

Very truly yours,

PRECISION METALSMITHS, INC.,

R. R. MILLER,
President.

RRM:rg.

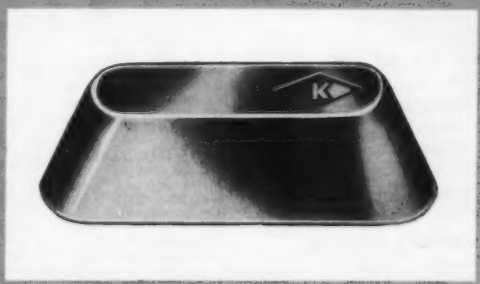
YOU TOO, CAN DO A BETTER JOB WITH LANLY OVENS

Write Today for Details and Let Us Show You How!

LANLY
FOUNDRY OVENS
THE LANLY COMPANY • 780 PROSPECT AVE
CLEVELAND, OHIO

HOW IS your I.Q.

✳ ingot quality



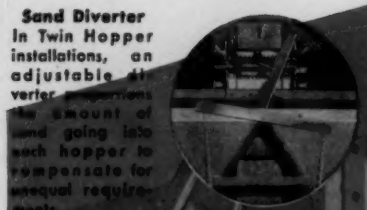
H. Kramer & Co., which has supplied ingot metals of the highest I. Q.* to foundrymen throughout the United States, is proud to participate in the 58th Annual American Foundrymen's Society Convention which will be held in Cleveland. It will give us an opportunity to meet again with the many friends who have always preferred H. Kramer & Co. I. Q.*

H. KRAMER & CO.

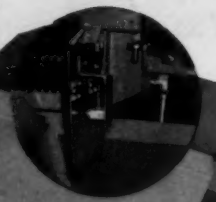
PLANTS: Chicago • Philadelphia • Los Angeles
(Ajax Metal Division)
OFFICES IN PRINCIPAL CITIES

Visit us in Booth No. 1702

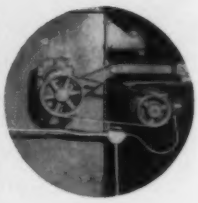
Sand Diverter
In Twin Hopper installations, an adjustable diverter proportions the amount of sand going into each hopper to compensate for unequal requirements.



Automatic Shutoff
The molder just starts the machine and forgets it. When the hoppers are full and sand reaches a predetermined level, the Handy Sandy shuts off automatically.



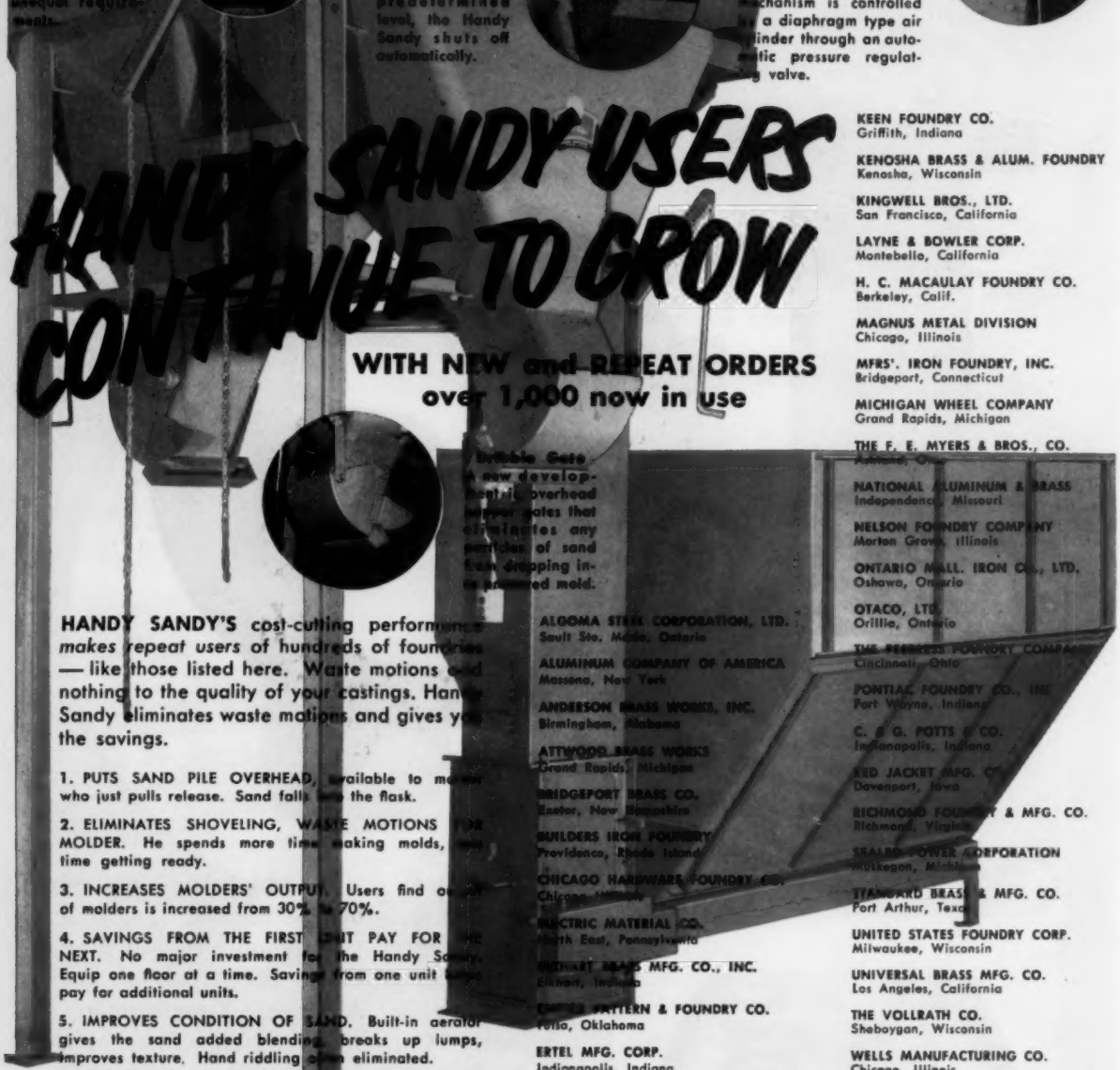
Automatic Elevator Head Takeup
The Automatic Takeup maintains perfect shaft alignment, constant elevator belt or chain tension, and positive V-Belt drive tension at all times, without operator's attention. The entire Takeup mechanism is controlled by a diaphragm type air cylinder through an automatic pressure regulating valve.



HANDY SANDY USERS CONTINUE TO GROW

WITH NEW and REPEAT ORDERS over 1,000 now in use

Bubble Gate
A new development, overhead hopper gates that eliminates any particles of sand from dropping in the completed mold.



HANDY SANDY'S cost-cutting performance *makes repeat users* of hundreds of foundries — like those listed here. Waste motions add nothing to the quality of your castings. Handy Sandy eliminates waste motions and gives you the savings.

1. PUTS SAND PILE OVERHEAD, available to molder who just pulls release. Sand falls into the flask.

2. ELIMINATES SHOVELING, WASTE MOTIONS FOR MOLDER. He spends more time making molds, less time getting ready.

3. INCREASES MOLDERS' OUTPUT. Users find output of molders is increased from 30% to 70%.

4. SAVINGS FROM THE FIRST UNIT PAY FOR THE NEXT. No major investment for the Handy Sandy. Equip one floor at a time. Savings from one unit help pay for additional units.

5. IMPROVES CONDITION OF SAND. Built-in aerator gives the sand added blending, breaks up lumps, improves texture. Hand riddling often eliminated.

6. TAKES LITTLE SPACE. Occupies no more floor space than sand pile. Requires little headroom, no structural changes required.

7. LOW COST — SIMPLE TO INSTALL. Compact, packaged unit installed in a few hours. *No expensive overhead conveyors, no pits or foundations.* Simplified design means low operating costs, dependable performance.

ALGOMA STEEL CORPORATION, LTD.
Sault Ste. Marie, Ontario

ALUMINUM COMPANY OF AMERICA
Massena, New York

ANDERSON BRASS WORKS, INC.
Birmingham, Alabama

ATTWOOD BRASS WORKS
Grand Rapids, Michigan

BRIDGEPORT BRASS CO.
Exeter, New Hampshire

BUILDERS IRON FOUNDRY
Providence, Rhode Island

CHICAGO HARDWARE FOUNDRY CO.
Chicago, Illinois

ELECTRIC MATERIAL CO.
North East, Pennsylvania

EMHART BRASS MFG. CO., INC.
Elkhart, Indiana

EMPIRE PATTERN & FOUNDRY CO.
Tulsa, Oklahoma

ERTEL MFG. CORP.
Indianapolis, Indiana

FOOD MACHINERY & CHEMICAL CORP.
Lakeland, Fla. — Los Angeles, Calif.

GOLDENS' FOUNDRY & MACH. CO.
Columbus, Georgia

HAMILTON BRASS & ALUM. CSTG. CO.
Hamilton, Ohio

HOOD RUBBER CO.
Watertown, Massachusetts

KEEN FOUNDRY CO.
Griffith, Indiana

KENOSHA BRASS & ALUM. FOUNDRY
Kenosha, Wisconsin

KINGWELL BROS., LTD.
San Francisco, California

LAYNE & BOWLER CORP.
Montebello, California

H. C. MACAULAY FOUNDRY CO.
Berkeley, Calif.

MAGNUS METAL DIVISION
Chicago, Illinois

MFRS'. IRON FOUNDRY, INC.
Bridgeport, Connecticut

MICHIGAN WHEEL COMPANY
Grand Rapids, Michigan

THE F. E. MYERS & BROS., CO.
Ashland, Ohio

NATIONAL ALUMINUM & BRASS
Independence, Missouri

NELSON FOUNDRY COMPANY
Morton Grove, Illinois

ONTARIO MALL. IRON CO., LTD.
Oshawa, Ontario

OTACO, LTD.
Orillia, Ontario

THE PEERLESS FOUNDRY COMPANY
Cincinnati, Ohio

PONTIAC FOUNDRY CO., INC.
Fort Wayne, Indiana

C. & G. POTTS & CO.
Indianapolis, Indiana

RED JACKET MFG. CO.
Davenport, Iowa

RICHMOND FOUNDRY & MFG. CO.
Richmond, Virginia

SEALED POWER CORPORATION
Muskegon, Michigan

STANDARD BRASS & MFG. CO.
Port Arthur, Texas

UNITED STATES FOUNDRY CORP.
Milwaukee, Wisconsin

UNIVERSAL BRASS MFG. CO.
Los Angeles, California

THE VOLLRATH CO.
Sheboygan, Wisconsin

WELLS MANUFACTURING CO.
Chicago, Illinois

WESTINGHOUSE ELECTRIC CORP.
Attica, New York

WEBER-KNAPP CO.
Jamestown, New York

J. A. WEAVER CO.
St. Louis, Missouri

Space permits only a partial listing of repeat users.

See our exhibit at the A. F. S. Show
Cleveland, May 8-14
Booths 1528-1530-1631-1633
Lower Lakeside Hall

NEWAY

Manufacturers of Neway® Mold Handling, Sand Handling and Conditioning Equipment

F.E.F. Meeting

continued from page 150

Detroit, C. H. Martin, M & H Valves & Fittings Co., Anniston, Ala., and R. C. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, all to serve three years; Robert Watts, American Brake Shoe Co., New York, two years; and T. H. Shartle, Texas Electric Steel Castings Co., Houston, Texas, one year.

While larger foundries have long recognized that education, recruiting, and use of properly trained engineering graduates is a vitally important factor in their present success and future prosperity, Dr. MacKenzie stated in his presidential address, smaller shops have felt that an engineer was a costly luxury. Such "engineering isolationism" would pass rapidly, he said in pointing out that future development of FEF lies with the small and medium-sized foundries.

How to recruit and to use engineering talent, regardless of the size of the shop, were brought out by two panel discussions staged the second day under the chairmanship of George K. Dreher, former executive director of FEF. Members of the recruiting panel, serving with Prof. P. E. Kyle, Cornell University, as moderator, were: E. C. Kubicek, Illinois Institute of Technology, and Arthur Bach, Case Institute of Technology, both placement directors, and B. C. Yearley, National Malleable & Steel Castings Co., Cleveland, and A. C. Hensel, Albion Malleable Iron Co., Albion, Mich., representing industry.

Turnover Percentage

In telling how and when a company determines its engineering and management manpower requirements, Mr. Hensel stated that a 3-5 per cent turnover was average for most companies. Personnel records, retirements coming up, and similar indications of manpower needs should be watched, he said. His company plans operations one, three, five, and ten years ahead, based on market research, and figures at least two years ahead on engineering and management personnel.

What plans should a company make and how far in advance should recruiting arrangements be made, Mr. Bach was asked. He advised a long-range program of visits with notification to the school of the company's needs three to six months in advance. Supply the school and the students with information on the plant, not company history, he warned. Give them up to date information and mention what the recruit will be doing, he said.

Field of engineering studied is unimportant, in general, Mr. Yearley said, adding that his company is interested not only in metallurgists but probably even more so in mechanical engineers since modern foundry operations revolve around material handling. There is ample opportunity for men with all types of engineering education in the foundry industry, he declared.

Asked who should do the interviewing, Mr. Kubicek reported on a survey of 200 companies which indicated that the average interviewer was a college graduate, had spent 11 years with his company (five of them as a recruiter), and devoted about 25 per cent of his time to recruiting. The interviewer must talk the language of the student and the educational institution, and must be able to represent the company well since in the eyes of the student he is the company.

Bach added that recruiters should be armed with full information on company policy regarding military leaves and deferments.

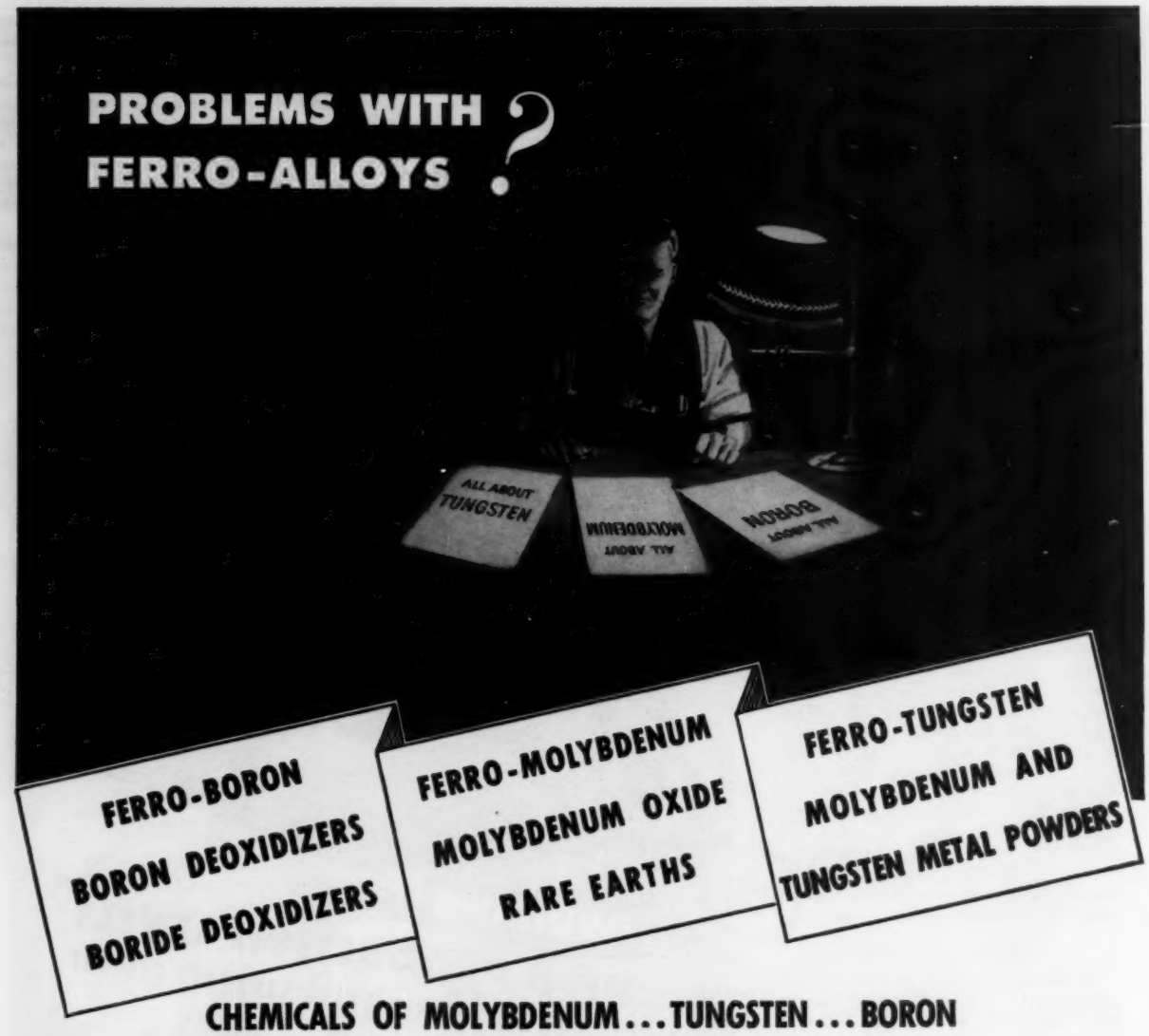
What information should a recruiter seek? Hensel said it was possible to get only a general impression in a 20-minute interview. He said he accepted the fact that a prospect was getting a degree as evidence of his competence. The big question was—will he fit into the organization?

Yearley pointed out that companies look for different attributes in a recruit, depending on his job. Different temperament and physique are required in a staff man and a shop man. A primary

continued on page 196

put GRINDING on the
HIGH PRODUCTION LEVEL!
with Standard's 35-A twin-motor snagging grinder
This No. 35-A is one of a battery of Standard Grinders at the Haven Malleable Iron Co., Cincinnati, grinding castings on a high production level.
The 35-A is a "two-in-one" machine, each operator and grinding wheel independent of the other. Wheel diameters may differ too, but both operate at the correct peripheral speed. Models vary from 5 H.P. up to 100 H.P. Write for Catalogue 44.
Foundries throughout the world are gaining these results:
• Increased Production
• Longer Wheel Life
• Higher Operating Efficiency
• Less Operator Fatigue
Standardize with
the STANDARD electrical tool co.
MACHINE TOOLS
2546 RIVER ROAD • CINCINNATI 4, • OHIO

See us in booth 601
Foundry Show—Cleveland



FERRO-BORON
BORON DEOXIDIZERS
BORIDE DEOXIDIZERS

FERRO-MOLYBDENUM
MOLYBDENUM OXIDE
RARE EARTHS

FERRO-TUNGSTEN
MOLYBDENUM AND
TUNGSTEN METAL POWDERS

CHEMICALS OF MOLYBDENUM...TUNGSTEN...BORON

Molybdenum is now available in unrestricted supply to improve strength and machinability. Dependable results are still one of its major attributes.

Tungsten, for hardenability and wearability improvement is now used in surprisingly small additions, with great success.

Boron, as an intensifier of the effects of other alloying materials, may be used in very minute additions, and yet maintain the essential properties of the castings desired. The most economical and satisfactory form to introduce Boron is recognized to be found in MCA's Ferro-Boron.

Operating the world's largest rare earth deposits, the Molybdenum Corporation of America has recently conducted extensive pioneering research in evaluating the properties, applications and uses of RareMeT Compound.

In nodular iron, small additions of rare earths have helped to produce consistently good ductility by counteracting subversive elements such as lead and titanium.

Write today for further information.

MOLYBDENUM

Grant Building CORPORATION OF AMERICA **Pittsburgh 19, Pa.**

Offices: Pittsburgh, Chicago, Detroit, Los Angeles, New York, San Francisco
Sales Representatives: Edgar L. Fink, Detroit; Brumley-Donaldson Co., Los Angeles, San Francisco
Subsidiary: Cleveland Tungsten, Inc., Cleveland *Plants:* Washington, Pa., York, Pa.

MCA

DAVENPORT MOLDING MACHINES sure cut down our MAINTENANCE COSTS

At the Show

BOOTH 1520

We will have a working display . . . Put your hands on the control levers—See for yourself!

DOWN TIME DUE TO MAINTENANCE means LOST PROFIT

Better Built—means dollars in your pocket. It pays to know that your foundry equipment will take it. Davenport Molding Machines are famous for years of dependable trouble-free service.

If you want sturdy construction with less servicing . . . be sure to look at Davenport Molding Machines. They have outstanding records of low maintenance costs.

Let us send you our complete catalog. You'll find Davenport has a size and model to help you lower your costs.

- JOLT ROLLOVER DRAW
- JOLT STRIPPER PIN LIFT
- JOLT SQUEEZE PIN LIFT

DAVENPORT MACHINE AND Foundry Company
DAVENPORT IOWA U.S.A.

REPRESENTATIVES

Canadian Foundry Supplies & Equip. Ltd., Toronto & Montreal

C. W. Lueders, Riverton, New Jersey

Teller Equipment Co., Port Murray, New Jersey

McArdle Equipment Co., Houston, Texas

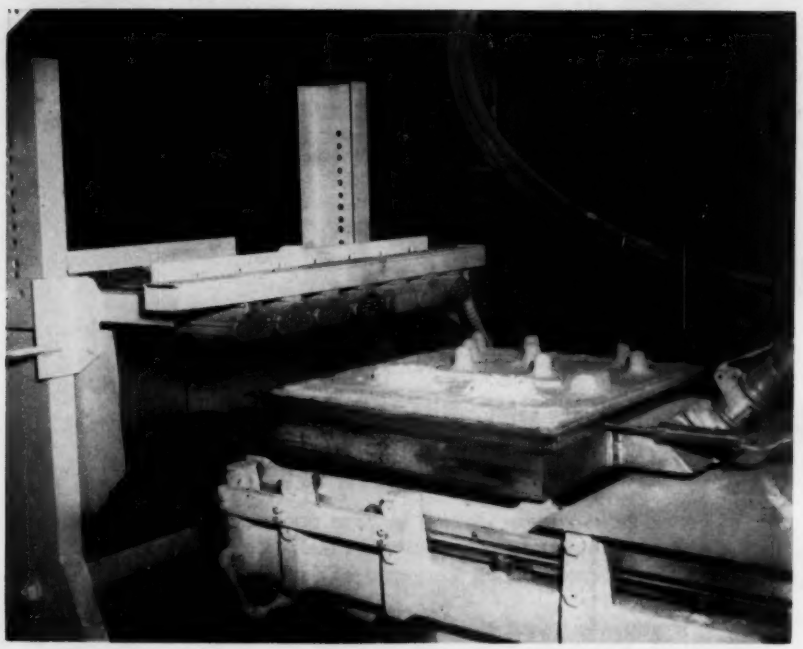
Grant & Company, Los Angeles, California

Ph. Bonvillain & E. Ronceray, Choisy-Le-Roi, Rue Paul Carle, Seine, France

Exhibits Preview

In this preview of products to be shown at the week-long AFS Foundry Show to be held in Cleveland May 8-14, are some of the newest tools of the metal castings industry. They are representative of the products of over 300 outstanding foundry equipment manufacturers, suppliers and service organizations who will display their products at the Show.

For more detailed information on products shown here fill in the postcard on page 187.

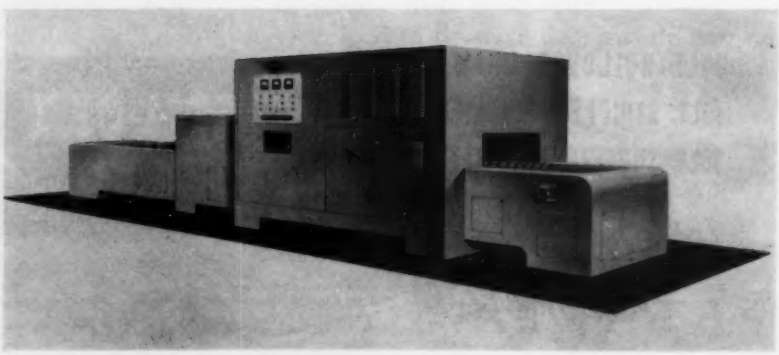


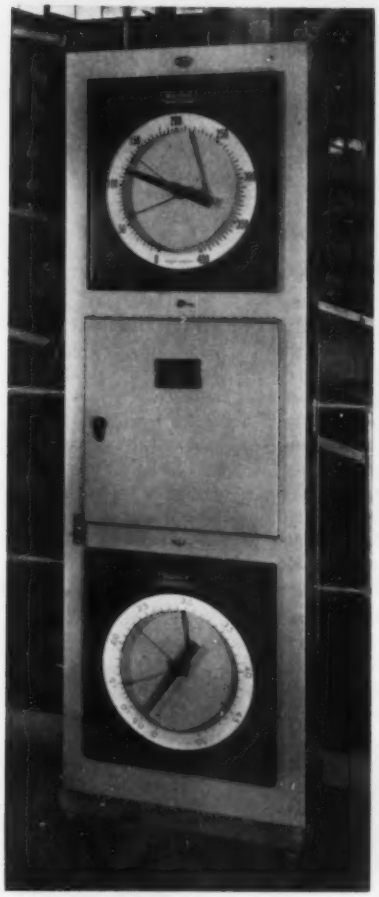
208. Infrared Furnace

One of the features of the Beardsley & Piper, Div. Pettibone Mulliken Corp exhibit will be the high-capacity far infrared type furnace for the curing of shells made on Beardsley & Piper Shell-formatic machines. With separate heat input to the pattern from below, and high-efficiency far infrared heat above, the shell is uniformly cured from both sides in minimum time. A perfect cure is obtained for all shells in 30 seconds or less.

209. Ther-Monic Core Tunnel

Induction Heating Corp will show for the first time a new Model M-900 Core Tunnel. It will feature a wide conveyor belt and electrode width both, 40 in. wide. The greater width permits a larger number of cores per foot, slower belt speeds, and easier loading. New features include enclosed oscillator and power supply under "positive pressure."



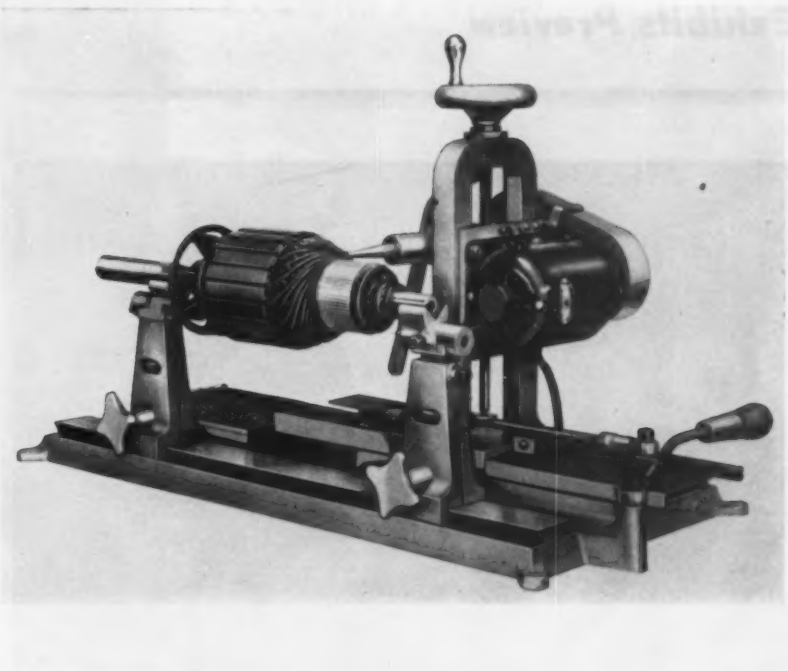


210. Sand Tempering Unit

Harry W. Dietert Co. will exhibit a Dietert-Detroit sand tempering unit. The automatic unit is a batch-type moisture determination unit—automatically adds the base water required to temper the sand in a mill. It determines the sand temperature and adds the correct amount of water to each mix to compensate for loss of moisture.

211. Dust Collector

An operating Schneible Multi-Wash Dust Collector with transparent shell will be featured to demonstrate the effective wet impingement method by Claude B. Schneible at the 1954 AFS Foundry Show in Cleveland. This collector will serve a standard Schneible Uni-Flo, Fractionating Shakeout Hood. A panel will be exhibited, showing arrangement diagram, data and installation photos of the Schneible Type "SW" Cupola Collectors. The keynote of the exhibit will be equipment within the means of the smaller foundries.



212. Bench Type Mica

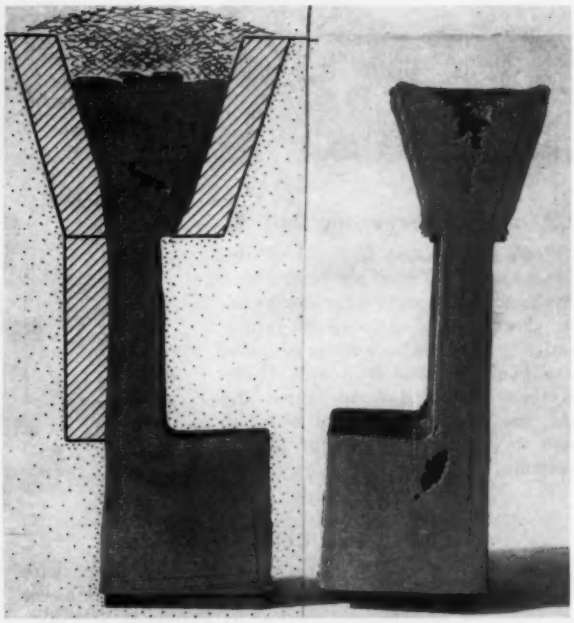
Martindale Electric Co. will feature Model HV-3 Bench Type Mica Undercutter at the AFS Foundry Show in Cleveland, May 8-14. The unit takes both horizontal and vertical commutators. It handles a wider variety of armature sizes and shaft lengths than any similar machine, it is claimed, and is designed for large volume production as well as service shop use. The carriage travels on ball bearings both horizontally and vertically, it is pointed out. The HV-3 undercuts horizontal commutators up to 6½ in. diam., 6½ in. long and vertical types up to 6 in. diam. It handles armatures 12 in. diam. on V-supports, 10½ in. on centers. The unit has 20 in. between centers.

⬅ 214. Furnaces

The nature of the equipment of Pittsburgh Lectromelt Furnace Corp., prevents them from exhibiting an actual furnace, but they will exhibit a scale model of one of their 12-ton capacity furnaces. This scale model is a top charge unit and will operate to the extent that the furnace roof can be raised and swung aside and also the furnace can be tilted. While it will not be arranged to melt metal, it is a detailed scale of the regular unit.

213. Foundry Flasks ⬆

Black, Sivalls & Bryson, Inc., will show as one of their featured items at the Foundry Show, the BS&B Heavy Duty Foundry Flask. The heavy duty all-welded, pressed steel foundry flasks are fabricated to withstand expansion and contraction without breakage of walls, bearings, and barring, it is pointed out. Vertical walls are of one continuous piece of steel. Bearing bars are securely welded to walls, both inside and out. Walls, bearings, and corners are formed separately, eliminating corner stresses that are common in the average fabricated flask. A reinforcing rib, when desired, is welded securely to the wall for even greater strength, it is claimed.



215. Exothermic Product ⬆

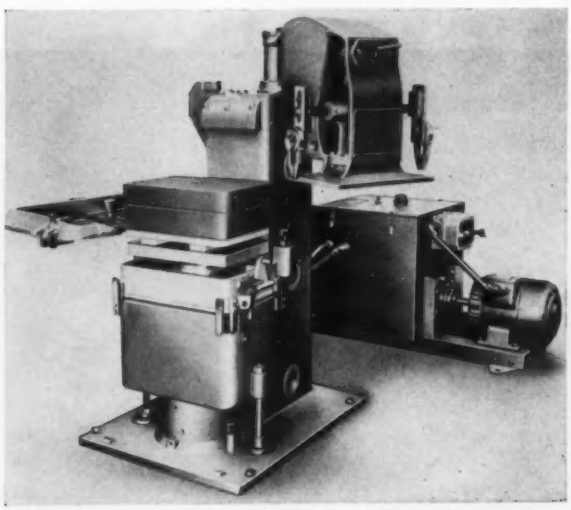
Exomet, Inc., Conneaut, Ohio, will feature castings made with Exmold and Exmold cores at the AFS Foundry Show. Exmold is a new moldable exothermic product developed by Exomet. This new material was developed for the ferrous and non-ferrous foundries. No odors are produced and even steel does not penetrate nor adhere to the solid frit formed by the reaction, it is claimed. By adding water, Exmold can be rammed into any desired shape, it is pointed out. Its exothermic reaction produces temperatures up to 3500 F and is non-contaminating. Its effectiveness can be evaluated through its use as a riser sleeve, and knock-off cores, it is claimed.

216. Pouring Installation

Whiting Corp. will show a typical mechanized pouring installation for the small foundry. This installation will simulate an actual pouring operation for use in a small foundry pouring up to approximately 25-30 tons of iron per day. It will include a hand pushed Trambeam underhung crane with ladle handler and 165 lb capacity side ladle, for pouring floor molds. Also included will be a section of Trambeam monorail with carrier, ladle handler and 1,000 lb capacity tapered side transfer ladle.

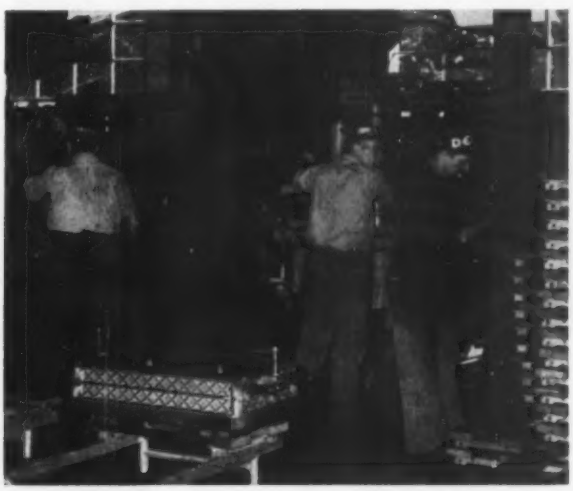
218. Small Foundry Equipment

Newaygo Engineering Co. will feature the Reddy-Sandy and Handy-Sandy at the AFS Foundry Show in Cleveland. The units afford complete mechanization for any size foundry, it is claimed. All sand-handling and conditioning operations are performed by using these two units in combination, it is pointed out. The sand never has to touch the floor but progresses in one continuous cycle through shake-out, sand-preparing and molding. There are no intermediate points where the sand has to be rehandled.



217. Boxless Molding Machine

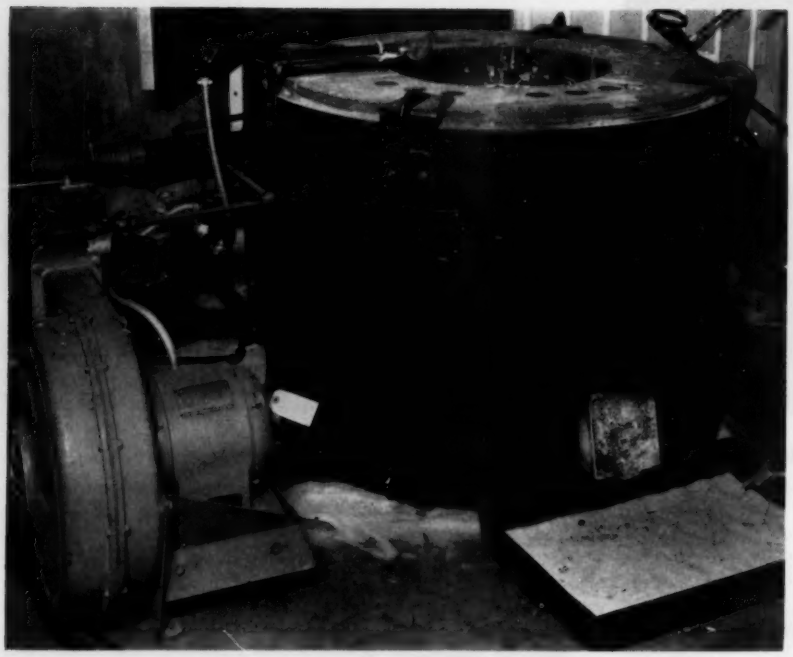
The SP-3210 Hydroil Electric Boxless Molding Machine will be featured by Sutter Products Co. at the Foundry Show. The machine produces molds for light shallow castings at great speed, entirely without molding boxes, snap or slip flasks. It incorporates permanent aluminum top and cast iron bottom "boxes". Double faced pattern or match plates must be used, as cope and drag are rammed simultaneously. A supply of bottom boards only is required.



219. Mold Pallets and Conveyor Lines

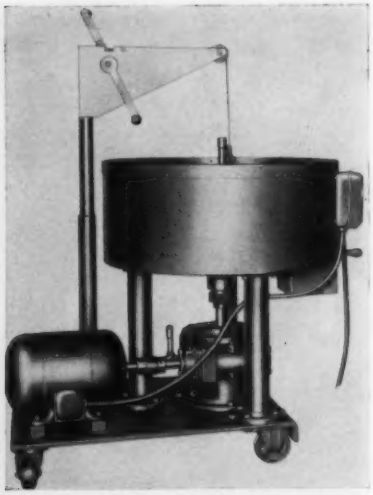
Nomad Foundry Equipment, Div. Westover Engineers, will feature mold pallets and conveyor lines especially designed for the miscellaneous casting shop. The pallets permit use of flask and mold equipment which the foundryman has, and will accommodate the variety and size of work found in this type of operation. The mold conveyor has a leveling device to compensate for uneven floors and is of the low type which does not require decking for convenience in pouring. Open construction to simplify housekeeping is included in construction of the line.

Exhibits Preview



220. Stationary Type Furnace

Campbell-Hausfeld Co. will show the Hausfeld Stationary Type Furnace in operation at the AFS Foundry Show, Booth 1011. Aluminum will be melted and held at a given temperature and used in connection with a complete shell molding operation. It will be complete with all automatic controls.



222. Muller

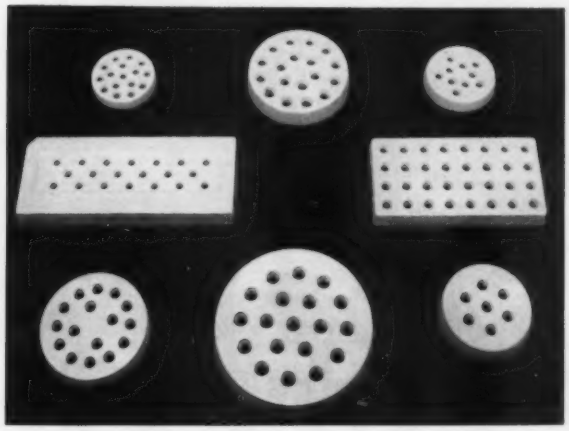
Buckeye Products Co. will introduce the new 24 x 36 in. Cincinnati Muller for general foundry use at the AFS Foundry Show. The muller is mounted on castors for easy moving. The manufacturer states that the wheels are equipped with sealed ball bearings while the motors are totally enclosed fan cooled ball bearing. The new muller can be thoroughly cleaned with a minimum of time and labor since the larger size is fitted with a hand-operated removable drum hoist to lift the muller assembly from the mixing pan. The scraper can be lifted out leaving a smooth surface to be cleaned with a rag, brush or air gun.

221. Spindle Sander

Oliver Machinery Co. will display their 381-D Oscillating Spindle Sander with power tilting features. The spindle is driven directly off from the motor arbor and its oscillating motor is derived by means of a worm and oscillating worm gear.

223. Core Binders

Hercules Powder Co. will feature Truline Binder at its exhibit at the AFS Foundry Show in Cleveland, May 8-14. The binder is a dry, pulverized, thermoplastic resin used to effectively bind iron and steel cores, it is said.



224. Ceramic Strainer Cores

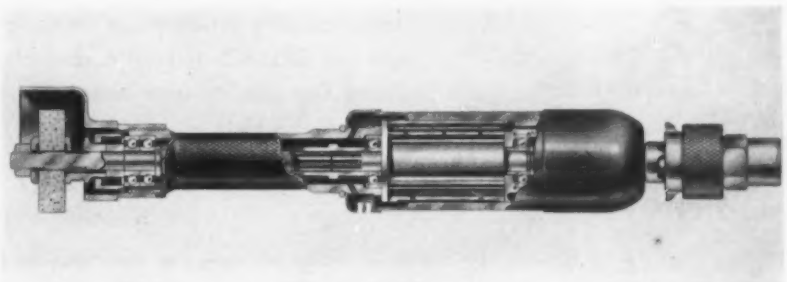
Williston & Co. will feature I. C. P. Ceramic Strainer Cores at the 1954 AFS Foundry Show to be held in Cleveland. Standard sized cores as well as many special sizes will be exhibited by the company.

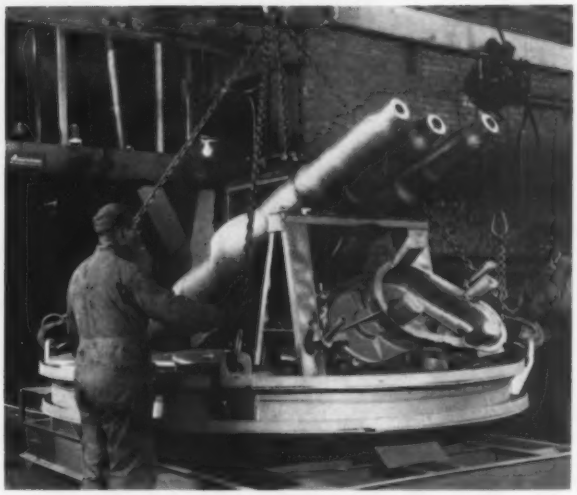
225. Central Sand Preparation

Royer Foundry & Machine Co. will feature the Royer, Model "NYP-E," with a capacity of 120-160 tons of sand per hour, in actual operation in conjunction with the new Royer "Scrap Control." Model NYP-E, with its large Extension Hopper, is capable of taking the entire load of 12½ cu ft front loading bucket in one discharge. It is built to stand up under heavy usage.

226. Grinders

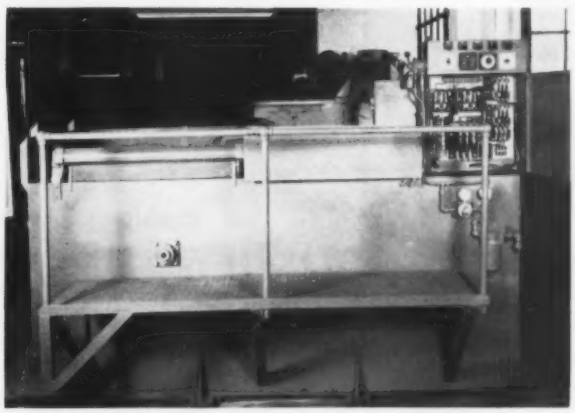
Among the Cleco Air Tools to be displayed at the Foundry Show are the new Series 14 Cleco Grinders recently announced by the Cleco Div., Reed Roller Bit Co. Cleco is also showing a complete line of grinders, sanders, chippers, scalers and sand rammers for foundry use.





227. Blast Cleaning Machines

American Wheelabrator & Equipment Corp. will show three Wheelabrator airless blast cleaning machines, two of them in operation. Also operating will be a Wheelabrator Car-type room. Part of the display will be a diorama of a flow diagram in lights, describing furnace fume collection in foundries.



228. Shell Molding Machine

Shell-O-Matic, Inc., will display in operation the Shell-O-Matic shell molding machine. The unit is push button operated, having a usable pattern area of 18 in. by 24 in.

continued on page 184

VISIT US AT OUR BOOTHS NOS. 1904-06 during the 58th ANNUAL A.F.S. CONVENTION
CLEVELAND, OHIO — MAY 8-14, 1954

DELTA FOUNDRY PRODUCTS

DEVELOPED IN LABORATORY RESEARCH

FOUNDRY TESTED AND APPROVED

MANUFACTURED UNDER SCIENTIFIC CONTROL

DELTA products for the foundry are PRODUCTS OF RESEARCH. For nearly twenty years many important scientific developments . . . valuable contributions to the advancement of foundry practices . . . have originated in DELTA'S laboratories where the most modern scientific facilities are employed in a continuing program of product research, development and standardization.

Every DELTA Foundry Product is first tested by laboratory methods then submitted for use and final approval in ACTUAL FOUNDRY PRACTICE before it is identified with the name "DELTA".

There is no "just as good" substitute for ANY Delta Foundry Product just as there is no substitute for DELTA'S scientific controls which safeguard the quality and uniformity of all DELTA Foundry Products.

FOR SAND

DELTA Permi-Bond (sea coal replacement)

Sand Conditioning Oils

96-B Sand Release Agent

FOR CORES

DELTA Core & Mold Washes for steel, malleable, gray iron and non-ferrous metals.

Mudding and Patching Compounds

No-Vein Compound

Dri-Bond Binder

Core Rod Dip Oils

Sand Conditioning Oils

Core Oils

Partex (Nut Shell Parting)

Liquid Parting

Bondite

FOR MOLDS

DELTA Core & Mold Washes for steel, malleable, gray iron and non-ferrous metals.

Partex (Nut Shell Parting)

Liquid Parting

Spray Binders

Bondite

FOR FASTER PRODUCTION OF BETTER, CLEANER CASTINGS AT LOWER COST

DELTA

Get the Facts...

Delta Technical Men will be at the booth to answer your questions and discuss with you problems relative to foundry practice. Working samples and complete literature on Delta Foundry Products will be sent to you on request for test purposes in your own foundry.

DELTA OIL PRODUCTS CO.

MANUFACTURERS OF SCIENTIFICALLY CONTROLLED FOUNDRY PRODUCTS

MILWAUKEE 9, WISCONSIN

Exhibits Preview

continued from page 181

229. Mold Conveyor

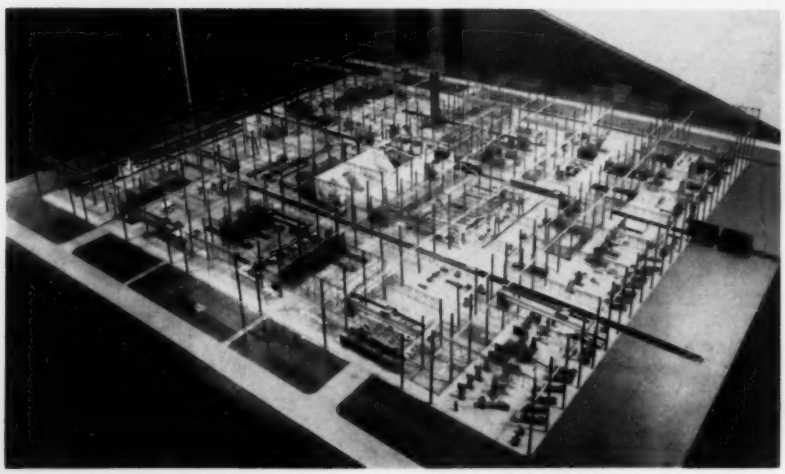
A new foundry mold conveyor, operating level and on grades over a 60-foot oval track, will be the chief feature of The Jeffrey Mfg. Co. The conveyor has articulated connections between cars, and internal type take-ups for easy vertical and horizontal movement. Also in operation at the Jeffrey booth will be an "MV" mechanical vibrating conveyor.

231. Metal Removal

Linde Air Products Co., Div., Union Carbide and Carbon Corp., will exhibit the Oxwell FSC-1. With this apparatus, an iron-rich powder is fed through oxy-acetylene preheat flames into a low-velocity oxygen stream where it burns and produces superheated liquid iron oxide. Heat from the combustion of the powder and from the slag produced, simplifies and speeds the removal of metal and metal-sand mixtures.

230. Direct Reader

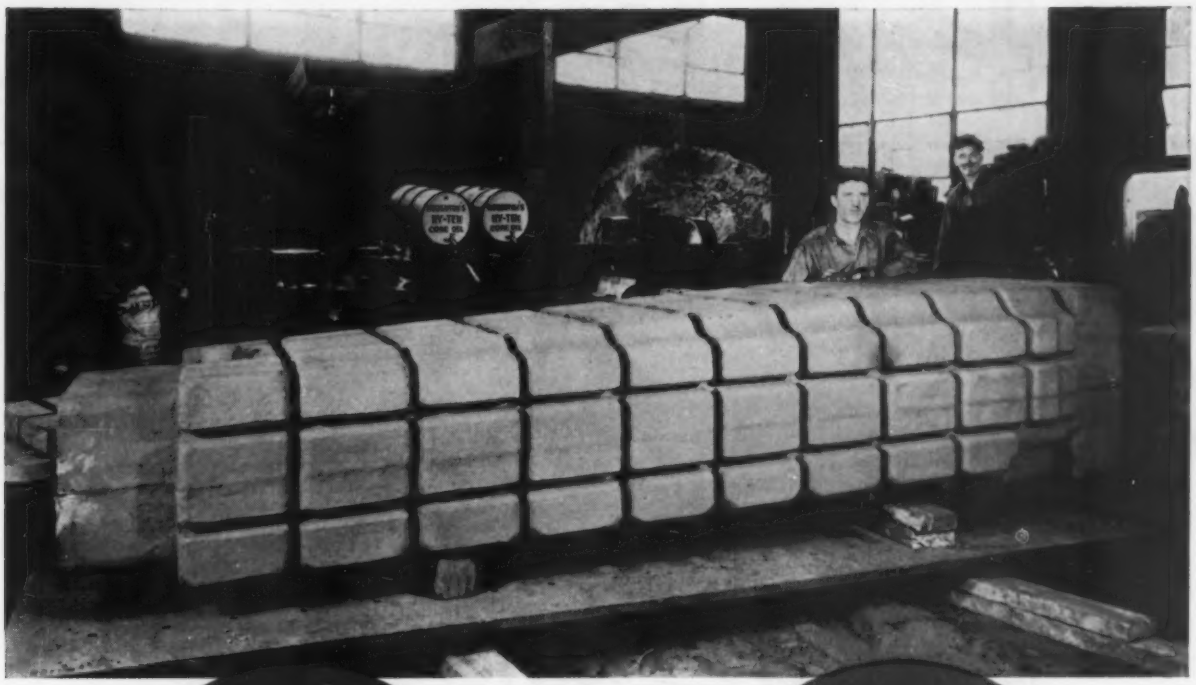
Baird Associates, Inc., will feature a graphic display including an animated optical system of the Direct Reader Spectrometer. The instrument is generally used in foundries and steel mills for 40-second analysis of the melt. It is used by aircraft manufacturers to test all incoming materials. The instrument's significant value is in the saving of time and the consequent cutting of costs.



232. Scale Model

A three-dimensional scale model grey iron and steel foundry, forge shop and machine shop will be featured by Lester B. Knight & Assoc. at the AFS Foundry Show. The model reproduces in ⅛ in. to one ft scale the 327,000 sq ft plant of Sulzer Brothers, Ltd., Winterthur, Switzerland. The plant manufactures diesel engines and has an annual production of 16,000 tons grey iron, 1,500 tons steel, 300 tons non-ferrous and 1,200 tons forgings.

continued on page 187



Core for this 9600-lb. boring machine casting is 14' x 48" x 42", weighs 5000 lbs. Made without chaplets, center filler of coke. Hy-Ten Core Oil used.

INCREASE YOUR SOUND CASTING YIELD...

WITH HOUGHTON HY-TEN CORE OIL SERVICE

Profits from a foundry operation depend on the yield of sound, true-to-pattern castings. To get good castings requires cores that can "take it". Cores that have sufficient green strength, that bake out thoroughly without overbaking, cores that do not "gas", that have adequate tensile strength, yet shake out cleanly and easily. And all these qualities are largely dependent on the performance of the core oil.

To get the best in core oil performance, call the Houghton Man. Ask him to tell you and show you how the controlled, catalytic, co-polymerization of Hy-Ten Core Oils assure you the best in core oil performance. You'll be interested, and it will prove profitable. Or, if more convenient, write E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa.

HY-TEN CORE OILS

...products of

E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

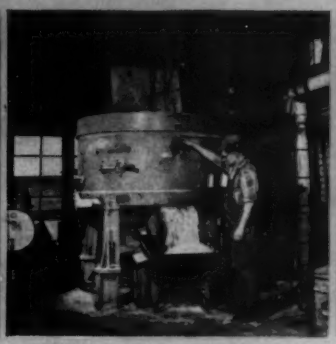
Ready to give you on-the-job service...

PROVED SUPERIOR

ACME RESIN

1 MULLING, tacky stage. Cold sand, liquid resin, and catalyst are charged into a standard muller.

2 MULLING, free-flowing stage. Each grain of sand *uniformly coated* —no critical control necessary.

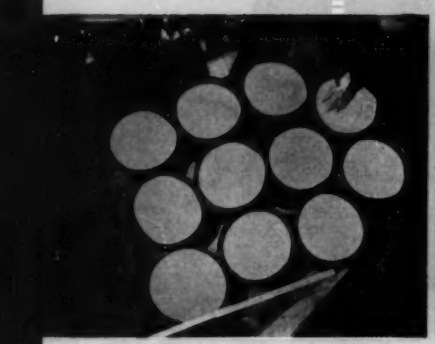


3 DISCHARGING. Sand is *dust-free*, cannot segregate from resin, green strength is controllable.

4 TWENTY-POWER magnification of resin-coated grains of sand after mulling process.

PlastiSand PROCESS

Resin formulation and the coating process covered by Patents Pending



5 COATED SAND, ready for use. Extremely *high tensile strength* at resin contents of from 2% to 4%.

6 BLOWN SHELL CORES. *Non-segregating* qualities lend themselves perfectly to shell and core blowing techniques.

7 STACK POURING of Alnico magnets, 12 to 16 high. 2% of resin produces necessary *high strength*, saves time and space.

8 SHAKE OUT—good collapsibility makes for easier shake out and better cleanup.

Pictures courtesy Mr. Raymond Kelly, Superintendent, Arnold Engineering Foundry, Marengo, Ill.

PLASTISAND Process utilizes a revolutionary new method for coating sand with liquid-resin for foundry shell molding.

This new development by Acme Resin Corporation in the field of shell molding has several positive advantages that overcome the primary deterrents to the use of the more widespread "C" or shell molding process.

Foundries using the PLASTISAND Process report PROVED SAVINGS, PROVED SAFETY and PROVED SUPERIORITY of molds with as little as one-half the resin content formerly necessary with dry resin.

With the PLASTISAND Process, a shorter dwell is possible and a faster cure is assured, from a shorter time on the pattern and a faster baking cycle.

Acme's new PLASTISAND Process is adaptable to dump-box, roll-over and blowing of either shells or cores. It uses either hot or cold mulling—in both, Acme liquid resin is used.

SEE THE PLASTISAND Process for yourself at the FOUNDRY SHOW in Cleveland, Ohio, MAY 8-14. Drop in to SPACE 1334.

An informative folder has been prepared to better acquaint the foundry industry with the new PLASTISAND Process. It may be obtained by writing to the ACME RESIN Corporation at the address listed here.

ACME RESIN CORPORATION

1401 CIRCLE AVENUE • FOREST PARK, ILLINOIS

Exhibits Preview

Fill out postcard below for complete information on products listed in these pages.

Continued from page 184

233. Electric Furnace

National Carbon Co., Div. Union Carbide and Carbon Corp., will feature a miniature electric furnace showing electrodes as focal point of the exhibit. A complete line of products will be exhibited with emphasis on products such as National Carbon, Acheson Graphite, Electrodes for arc furnaces, National Graphite Ingot Stool Inserts, Graphite molds for a variety of applications and many other products.

234. Head Wear Plates

A. I. C. Engineering Co. is featuring rubber trunnion-head wear plates at the AFS Foundry Show. The plates have been specially designed and engineered to make it possible for replacing the maximum wear area in the center in accordance with wear curves. It is possible, it is claimed, with these discs, to replace the 23 in. diameter inserts up to five times before it is necessary to replace the large well-disc.

235. Information Center

American Gas Association will have an Information Center at the AFS Foundry Congress where industrial fuel engineers of the East Ohio Gas Co. will be in attendance. Its purpose is to make available to visiting foundrymen, information on the uses of gas fuel in the foundry and to answer questions on problems which they may have in the utilization of gas in the foundry.

236. Core Oil

Magie Brothers will feature a faster baking core oil, which reaches its peak strength earlier in the baking period. The oil is called Fastrbake and another of its characteristics is that it retains its strength well in the overbaking period, it is claimed.

237. Twin Molding Machine

Maschinenfabrik & Eisengiesserei, Kallnach, Switzerland, will show the MK 2 Twin Molding Machine at the AFS Foundry Show in Cleveland. Some of the features pointed out are: two box parts are molded simultaneously; whether in service for jolting or squeezing, the cylinders can be actuated individually or jointly with the same control handle.

238. Core Baking Unit

A Thermex Model 75CA electronic sand core baking unit will be displayed by the Girdler Co., Thermex Div. It has a capacity of 4,250 lb of resin bonded cores per hr, and will handle cores up to four ft wide and 18 in. high, it is claimed. The unit is 42 ft 7 in. long and 72 in. wide.

239. Jacket

Adams Co. will feature the Adams Jacket, cast iron and aluminum, at the Foundry Show. Construction details include, inside surface grinding, milling ends to size and taper, jig drilling sides and ends and template assembling.

240. Gamma Rays Machine

Gamma Industries, Inc., will feature the Gamma Rays machine, which by using radio isotopes, records on film any porosity, blowholes, shrinkage, cavities or foreign matter present in the castings. Minimum operating costs are involved, it is claimed.

241. Dust Collector

Pulverizing Machinery Div., Metals Disintegrating Co., will exhibit a small working size of the 16-filter cylinder Midro-Collector at the AFS Foundry Show in Cleveland May 8-14.

continued on page 192

Exhibits Preview

54|5 **Please send me detailed information on the Products and Processes.**

208	209	210	211	212	213	214	215
216	217	218	219	220	221	222	223
224	225	226	227	228	229	230	231
232	233	234	235	236	237	238	239
240	241	242	243	244	245	246	247
248	249	250	251	252	253	254	255
256	257	258	259	260	261	262	263
264	265	266	267	268	269	270	271
272	273	274	275	276	277	278	279
280	281	282	283	284	285	286	287
288	289	290	291	292	293	294	295
296	297	298	299	300	301	302	303
304	305	306	307	308	309	310	311

★ Please print or type information below

NAME

TITLE

COMPANY

ADDRESS

CITY AND ZONE

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 14680, Sec. 34.9 P. L. & R. CHICAGO, ILL.

Reader Service

AMERICAN FOUNDRYMAN

616 S. Michigan Avenue

Chicago 5, Illinois

Free Foundry Information

For additional information

use postcard at bottom of this page

Exhaust Hoods

Volume No. 2, "Manual of Exhaust Hood Designs," has engineering reference on hood designs and applications for foundry dust control systems. Contains tables of exhaust requirements; dust concentrations and weights of collected material; hood sketches; and over 60 foundry installation photos. *American Air Filter Co.*

For more data, circle No. 294 on card

Paintstiks

Folder illustrating many uses for the Markal Paintstiks describes eleven of the various types available. Also contains chart listing material to be marked; type of surface; temperature; special process, and type of Paintstik to be used for the job. *Markal Co.*

For more data, circle No. 295 on card

Foundry Conveyors

Catalog No. 16 contains typical applications for foundry conveyors in all types of foundry operations. Booklet is illustrated with photos showing installations in the various foundry operations. Also available is folder describing X-Series new type ball bearing for conveyor rolls. *Logan Co.*

For more data, circle No. 296 on card

Pattern Coating

Reprint of a paper presented at the 1953 AFS Convention, "Research in Pattern Coating Produces Quality Castings," by Charles J. Berg, is now available. Paper is reprinted from AFS Transactions, Vol. 61, and is made available by *The Kindt-Collins Co.*

For more data, circle No. 297 on card

Glove Selector

Pocket-size slide chart shows how each type of Surety industrial gloves—Sureseal, standard synthetic and natural rubber—stands up against more than 70 different kinds of acids, oils, solvents, chemicals, abrasives and natural elements. Selector shows at a glance the correct glove for every industrial need by rating the gloves according to their resistance to various kinds of destructive elements. *Surety Rubber Co.*

For more data, circle No. 298 on card

Quality Control

Booklet describes a recent study of quality control methods at the Ford Cleveland Foundry. Points out how Ford controls the quality of its engine components in a variety of ways. One method of quality control is by quantitive analysis of certain elements in the molten metal from which castings such as blocks, cylinder heads, flywheels, and miscellaneous parts are made. *Baird Associates, Inc.*

For more data, circle No. 299 on card

pH Control

Bulletin 92-C, "What Every Executive Should Know About pH," describes pH, and the pH scale. Also describes how pH is measured and how modern pH control is used. *Beckman Instruments.*

For more data, circle No. 300 on card

Properties of "S" Monel

Technical booklet on the engineering properties of "S" Monel is now available. "S" Monel, it is explained, is an age-hardenable casting alloy that provides unusual strength, hardness and anti-galling properties at temperatures up to 1100 F. in addition to the general corrosion resistance of Monel. *Development and Research Div., International Nickel Co.*

For more data, circle No. 301 on card

Abrasive Materials

Catalog No. AB-53 carries a detailed description of "Blastrite" line of abrasive materials, including chilled cast iron, Hi-alloy "B" cast iron and malleable shot and grit, as well as steel and cut steel wire shot. Each product, its properties and uses, is fully explained. Included is a consumption chart, based upon experience under average conditions, which lists the various types of abrasives and their consumption in pounds per wheel hour. *Abrasive Shot & Grit Co.*

For more data, circle No. 302 on card

continued on page 214

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit No. 14680, Sec. 34.9 P. L. & R. CHICAGO, ILL.

Reader Service

AMERICAN FOUNDRYMAN

616 S. Michigan Avenue

Chicago 5, Illinois

Reader Service Dept.

54|5

Please send me detailed information on the Foundry Information circled.

208	209	210	211	212	213	214	215
216	217	218	219	220	221	222	223
224	225	226	227	228	229	230	231
232	233	234	235	236	237	238	239
240	241	242	243	244	245	246	247
248	249	250	251	252	253	254	255
256	257	258	259	260	261	262	263
264	265	266	267	268	269	270	271
272	273	274	275	276	277	278	279
280	281	282	283	284	285	286	287
288	289	290	291	292	293	294	295
296	297	298	299	300	301	302	303
304	305	306	307	308	309	310	311

★ Please print or type information below

NAME

TITLE

COMPANY

ADDRESS

CITY AND ZONE

Why has the steel industry invested in 108 NATIONAL CARBON TRADE-MARK blast furnace linings?

"National" carbon is found in more than 40% of this country's blast furnaces.

Why? Like any other investment by cost-minded steel producers, "National" carbon linings are bought on the basis of consistent, *proved* performance. Again and again, in over a hundred campaigns, "National" carbon linings have delivered:

- ***Consistently* longer life**
- ***Consistently* smoother operation (even during blow-in after bank)**

Here's the record: **31** "National" linings have *averaged* **2½** million tons per campaign. Of these, **18** have produced *more* than **2½** million tons and one is well over the **3¼** million mark. They're still going strong!

The terms "National" is a registered trade-mark of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.
District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
IN CANADA: Union Carbide Canada Limited, Toronto

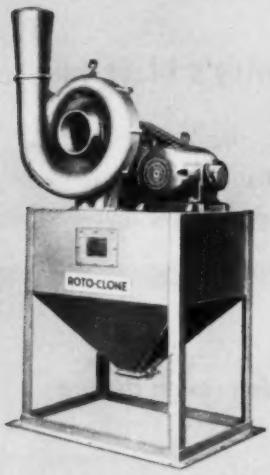
NATIONAL CARBON PRODUCTS

BLAST FURNACE LININGS • BRICK • CINDER NOTCH LINERS • CINDER NOTCH PLUGS • SKIMMER BLOCKS • SPLASH PLATES • RUNOUT TROUGH LINERS • MOLD PLUGS • TANK HEATERS

DROP YOUR AIR POLLUTION

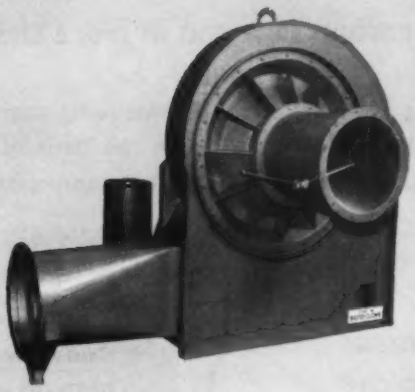
Dust control for snag, swing frame and portable grinding; chipping and abrasive cut-off.

Shakeout dust control from side hoods!



Type D ROTO-CLONE

The lowest cost collector, in the 1,500 to 15,000 cfm capacity range, designed for handling dry, granular dust! This dynamic precipitator combines high efficiency collector, exhauster, motor, drive and dust storage hopper in one compact, easily installed package. Collection efficiency of the Type D remains constant regardless of exhaust volume handled. Quality construction throughout assures long, maintenance-free service. Write for Bulletin No. 272.



Type W ROTO-CLONE

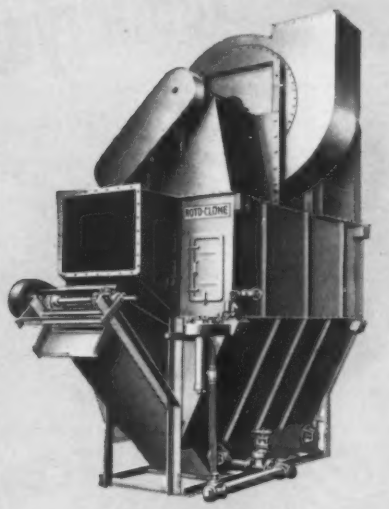
The lowest priced wet dust collector in its class (units of 1,500 to 50,000 cfm capacity designed for high efficiency dust collection). The Type W is a dynamic precipitator which, by adding a moving water film on the collecting surfaces, extends its effectiveness to collection of the finest, lightest particles. Unit is completely shop-assembled—includes collector, exhauster, motor and drive. Write for Bulletin No. 274.

See this equipment—discuss your dust problems at AAF BOOTH 1219, 1954 Foundry Show, Cleveland, May 8-14.

AAF

PROBLEMS HERE!

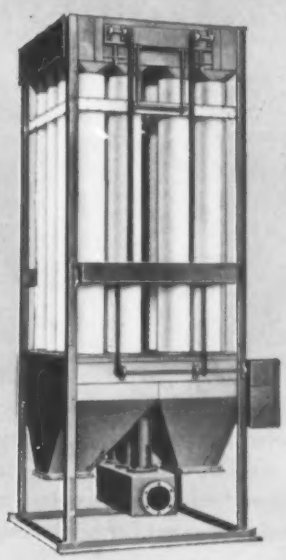
Effective dust control for abrasive cleaning, tumbling mills, sand conditioners and high dust load shakeouts.



New Design 4
Type N ROTO-CLONE

This famous AAF hydro-static dust collector, while retaining the high efficiency cleaning action of its inverted S-shape water curtain, now adds many new features designed to further reduce and simplify maintenance, increase service life and *lower cost*. Addition of 4 larger sizes permits handling of exhaust volumes up to 50,000 cfm. Write for Bulletin No. 277.

Collecting metallic fumes from melting operations where visible smoke in discharge stacks is objectionable.



AMER jet

A better reverse jet type fabric dust arrester built to exacting AAF design and performance standards, namely—small space requirements; maintained performance over a wide range of operating conditions; constant exhaust volume; high collection efficiency. AMER-jet is available for handling any exhaust volume. Write for Bulletin No. 279.

American Air Filter
COMPANY, INC.
104 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.

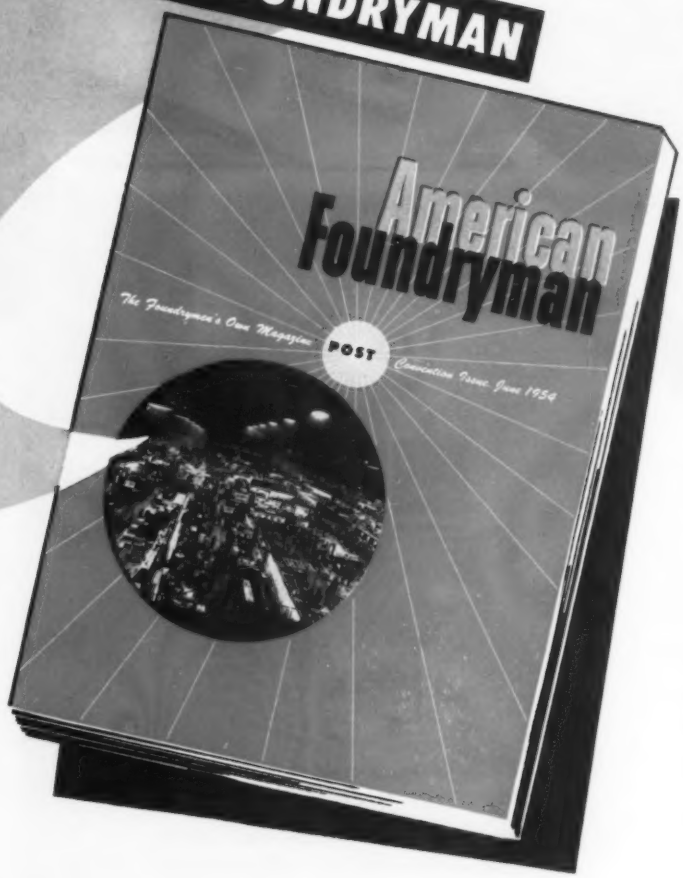
AAF

WATCH

for the JUNE AMERICAN FOUNDRYMAN

OFFICIAL REVIEW OF THE AFS INTERNATIONAL FOUNDRY CONGRESS

Foundrymen everywhere will want an authentic record of events related to the International Foundry Congress and Show . . . and the June issue of AMERICAN FOUNDRYMAN will be replete with Covention details.



AMERICAN FOUNDRYMAN is edited expressly for the purpose of rendering maximum service to the foundry industry. Small foundries as well as big plants regularly are considered when technical-practical material is selected and prepared for each issue.

By circulating the official record of the AFS International Foundry Congress to every major foundry center, AMERICAN FOUNDRYMAN will make it possible for this Important Industry Convention to be relived by the thousands of foundrymen who naturally will turn to AMERICAN FOUNDRYMAN for a comprehensive review of events that transpired in Cleveland.

For those foundrymen who cannot attend this function in person, the June AMERICAN FOUNDRYMAN will be the link to the latest techniques and developments . . . to new equipment . . . to major business and social events that will influence the future of a leading mass production industry.

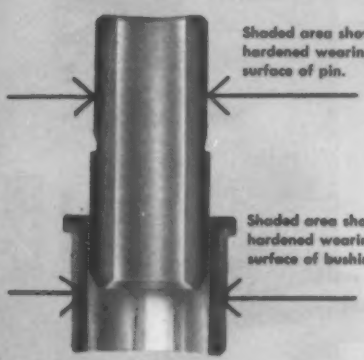
That's why all divisions of the foundry field will watch the . . . . . **JUNE AMERICAN FOUNDRYMAN**

ABC

Official Publication of the
American Foundrymen's Society
616 South Michigan Avenue
Chicago 5, Illinois

carburized and hardened wearing surfaces increase life of UNIVERSAL flask pins and bushings

The wearing surfaces of Universal flask pins and bushings are carburized and hardened so they can take long, rigorous wear and rough treatment in the foundry. Both pins and bushings are double quenched and double drawn to produce strong ductile cores with a fine grain structure that will withstand considerable stress and strain without breaking. Universal flask pins and bushings are precision ground to extremely close tolerances to insure instant, accurate alignment of cope and drag. Plain, taper, round, hexagonal and threaded series pins and bushings are available in a complete range of sizes as regular stock items. For complete information, write to the office nearest you — Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wisc., or the home office.

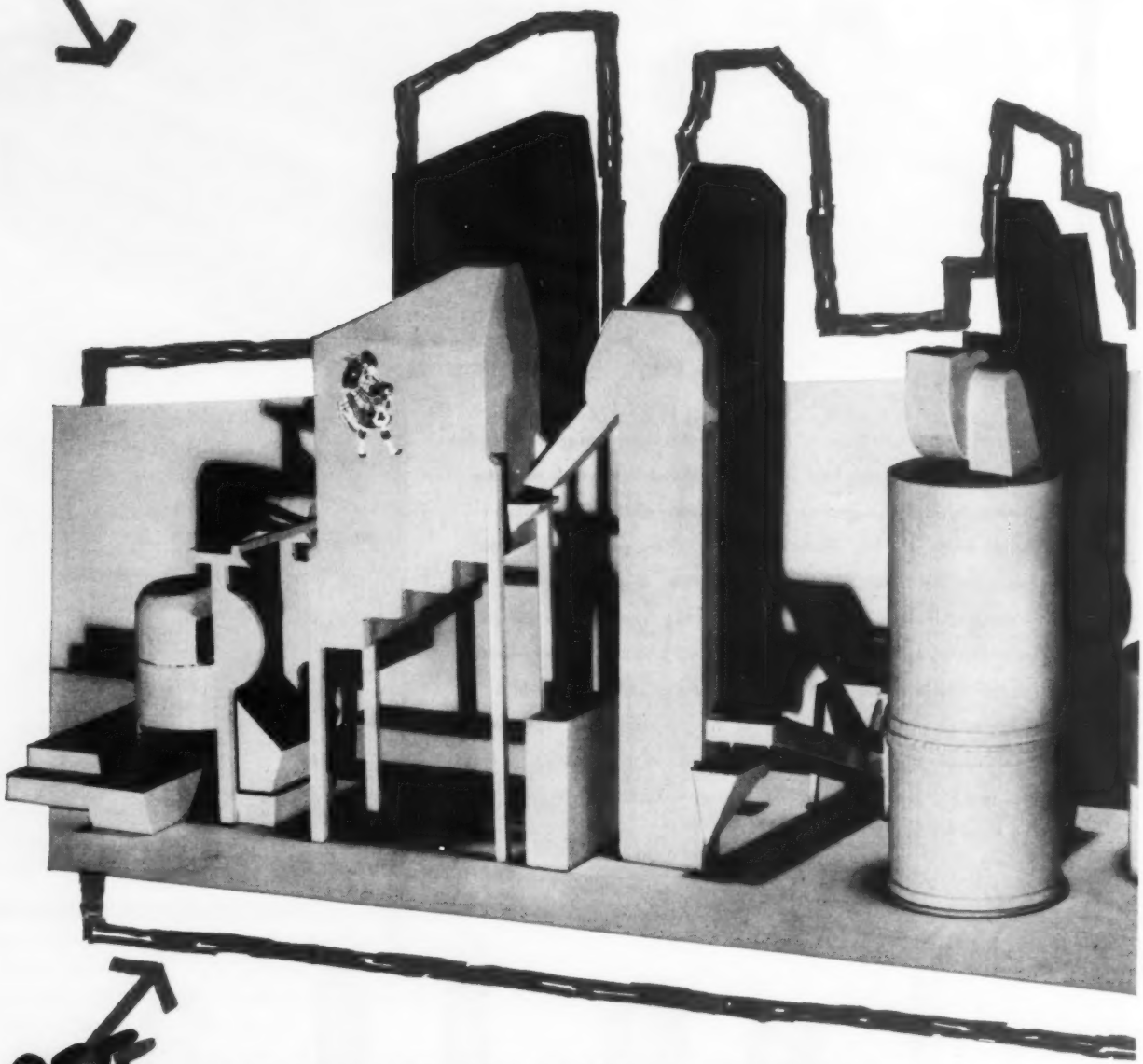


184

UNIVERSAL ENGINEERING COMPANY FRANKENMUTH 12, MICHIGAN

SEE

MODERN SAND RECOVERY PROVEN



SEE

WASTE SAND RECLAIMED, REBONDED and RETURNED for reuse in cores for production use at two leading Cleveland foundries. A National Sand Recovery Unit will reclaim it . . . a National Hydro Filter will collect all fines and waste material . . . a New Simpson No. 1 Model F Mix-Muller will rebond the reclaimed sand.

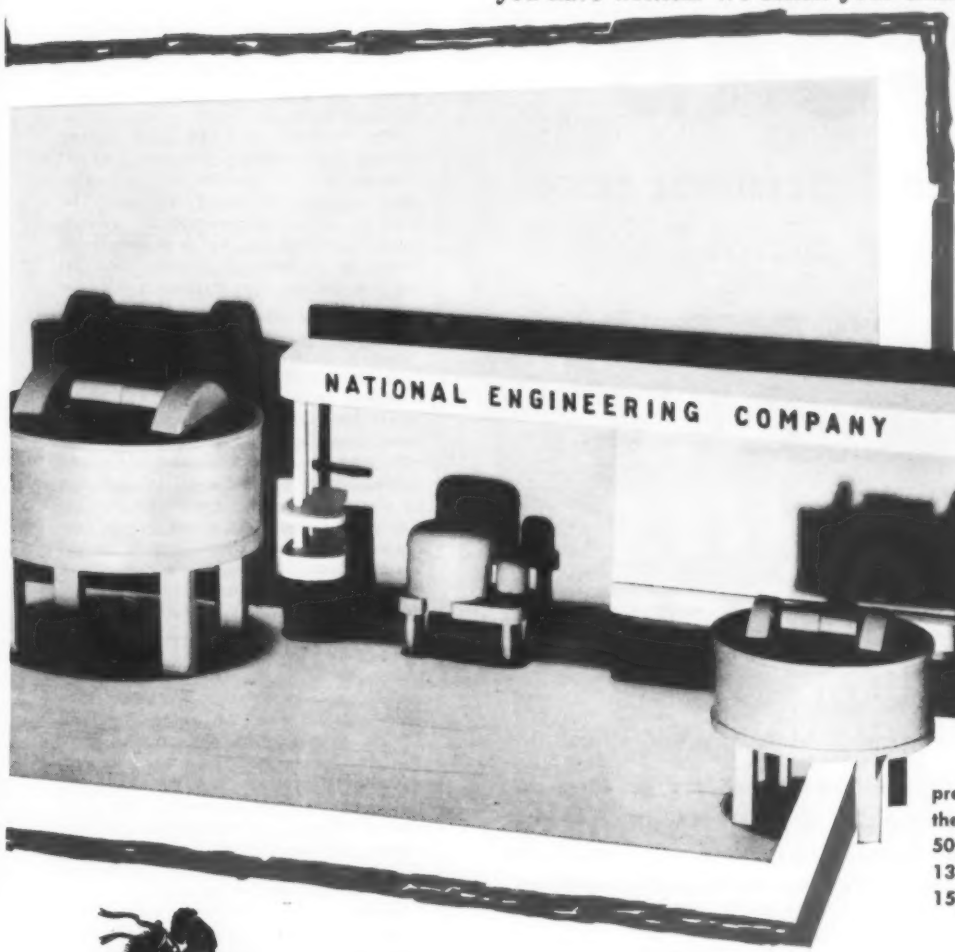
YOU can *feel* it, *see* it as it comes in as waste—watch the entire process from a vantage point; See it, feel its quality before the sand is returned for reuse. And too . . . you can make arrangements to watch it made into cores in an inspection visit.

IN DRAMATIC OPERATING EXHIBIT

NATIONAL Engineering Company Booth at CLEVELAND in MAY

SEE

THE NEWEST F SERIES SIMPSON MIX-MULLERS, now available in a complete range of batch capacities of from 25 to 4000 lbs. See the LF Laboratory Model, the *brand* new 1000 lb. No. 1½ Model F—The proven and popular 4000 lb. No. 3F. See the new No. 1 Model F in operation on 500 lb. batches. Here is your chance to examine modern mulling at first hand; talk to people to whom you have written. We solicit your examination and appraisal—not your buttonhole. Visit NATIONAL while in Cleveland—see for yourself why and how an F Series SIMPSON MIX-MULLER can put *modern* mulling in your plant . . . at an outstanding value per dollar investment!



SEE Simpson Mix-Mullers preparing either resin or sand in the following booths:
509 • 511 • 513 • 1310 • 1312 • 1314 • 1316 • 1334 • 1438 • 1506 and others.

National Engineering Company
(Not Inc.)
630 Machinery Hall Bldg. • Chicago 6, Illinois

NATIONAL SAND PREPARING & MOLD HANDLING SYSTEMS

SIMPSON *Intensive* MIX-MULLERS

F.E.F. Meeting

continued from page 173

consideration is whether the man is well adjusted, he said.

Average cost per man hired of a recruiting program was probably about $500 the panel agreed, but this depended on such factors as whether the company paid to move a man, etc. Many companies figure $3000-5000 including the cost of training, Bach said.

Starting salaries were predicted to be around $375 per month by June 1954. Hensel warned that engineering graduates were expecting too much and would price themselves out of the market. Due to high demand and low supply, he said, salaries have gone up out of proportion to living costs. Yearley said excessive starting salaries for engineering graduates could throw the pay scale out of balance, resulting in resentment on the part of older men with considerable experience. Bach pointed out that industry had bid the starting salaries up, Kubicek adding that a higher proportion of current recruits were going into sales, hence the higher starting salaries.

A second panel considered the absorption and utilization of engineering talent by the foundry industry. R. V. Righter, Central Foundry Div., General Motors Corp., Danville, Ill., was moderator. Panel members were: Edward Metzger, Multi-Cast Corp., Wauseon, Ohio; F. J. Walls, International Nickel Co., Detroit; W. J. Hebard, Continental Foundry & Machine Co., East Chicago, Ind.; and Charles F. Seelbach, Jr., Forest City Foundries Co., Cleveland.

Engineers are normally hired, for immediate purposes following training, Mr. Hebard replied to the first question, for operations and sales with a few for research. Benefit of a training period, Mr. Walls stated, was the opportunity it gave a recruit to get acquainted with his co-workers and to do his own thinking. Recruits should be treated as individuals and should spend more time in orientation and less in training. Mr. Metzger added that in a smaller company the recruit had to take pretty much what was available but that he should be given individual treatment and kept busy.

Mr. Seelbach said an FEF survey showed that training programs ranged from eight to 24 months in length with most running 12 to 18 months. Too brief an orientation period is undesirable, he pointed out, but it is sometimes necessary to push a trainee into an opening before his training period is over.

Management Support Needed

A basic training program must have complete support of management at all levels and should have definite objectives, said Hebard. Walls said that specific jobs, rotating jobs, and classroom methods were all useful in training, but in any case the trainee should not report to someone whose sole job is production. A trainee should report to top management, Metzger added, and should be responsible to some one individual.

Seelbach emphasized that the trainee needs to be rated and that his progress should be discussed with him. The man making the rating should confer with those directly over the trainee, he said. Mr. Righter said he preferred to have the shop supervisors rate the trainees. A training program can be evaluated, Seelbach declared, by noting the progress of trainees in the organization, their value to the organization, how many stay with the company, and by getting the viewpoint of the trainees.

Walls said a training program was feasible and economically possible in a small shop, and Hebard said steps in getting started were to recognize the need, to recognize that something can be done, then to start doing it.

In his presidential address, Dr. MacKenzie had expressed confidence in the American Foundrymen's Society's new program for bringing young men into the foundry industry and had assured complete FEF cooperation. Ashley B. Sinnett, AFS educational director start-

continued on next page

• Can ceramic strainer cores give you better castings at lower costs than sand strainer cores made in your own plant? Investigate! Make this test—free!

Just tell us the sizes and quantities of sand strainer cores you are now using, or send us samples of your sand cores. In turn we will send you samples from our large stock of standard size ceramic cores for this test. Don't miss this chance to compare. Write today to Dept. AF-5.

Porcelain Products' Ceramic Strainer Cores are available in a wide range of standard sizes—or, on special order, in sizes to meet your specifications.

60 years Porcelain Products, Inc. PP INC.
FINDLAY, OHIO

F.E.F. Meeting

continued from page 196

ing April 1, outlined the program. As objectives, he gave:

1. Develop within the limits of secondary industrial arts curricula, units of study pertinent to the cast metals industry.
2. Establish, rehabilitate, and assist in foundry programs at the technical vocational high school level.
3. Provide a central source of information concerning curricula, physical equipment, and informative literature for school administrators, educators, vocational school students, and foundry operators.
4. Develop a library of audio-visual and visual teaching aids.
5. Coordinate the interests of the men of industry and school personnel in achieving the above objectives.
6. Assist in administering foundry apprenticeship programs.
7. Assist in furthering programs of in-plant training.

Mr. Sinnet went on to suggest how these objectives might be attained. (Full program will be published in an early issue of AMERICAN FOUNDRYMAN.)

Banquet speaker was John T. Rettaliata, president of Illinois Institute of Technology. Engineers and educators should play complementary roles in society, he said. He recommended they work together to help the public understand scientists and engineers whose roles are often misunderstood. These men are vital parts of our economy, not materialistic exponents of gadgets and inventors of diabolical weapons of destruction, he declared. Their major objective is to make the world a better place in which to work and live.

Educators' Obligations

Turning directly to the problems of educators and educational institutions, Dr. Rettaliata pointed out their obligation to produce more and better engineers, to expand research programs, to advance technology toward higher productivity to provide for an increasing population, and to drop any aloof, ivory-tower attitude they might have. He cited the plight of educational institutions cut off from private donors of funds, stating that corporate philanthropy is necessary for their continued growth.

FEF Board Chairman M. J. Allen, American Steel Foundries, Chicago, presided at the banquet.

Much of one day was devoted to educators' shop talk, with representatives of most of 14 cooperating schools outlining some of their current activities. Wm. G. Gude, *Foundry*, preceded the discussion of university activities with a report on foundry industry trends. Presiding at these sessions was FEF Executive Director E. J. Walsh.

continued on page 204

with STARRBIDE

CARBON-BONDED SLAG HOLE BLOCKS

Longer Cupola Runs because Starrbide Carbon-bonded slag hole blocks stay in use longer than ordinary blocks.

Reduced Erosion from heat and slag flow to an amazing minimum.

Improved Flow Control because runs are longer, more easily scheduled.

Higher Thermal Conductivity rapidly dissipates heat.

Greater Production because shutdowns are reduced.

AMERICAN REFRACTORIES & CRUCIBLE CORP. NORTH HAVEN CONNECTICUT

ALSO MAKERS OF FAMOUS STARRBIDE CARBON-BONDED CRUCIBLES, GRAPHITE CRUCIBLES AND SUPER REFRACTORIES.

IRON AND STEEL SHOPS SAVE WITH TRULINE®

Today's accent on economy offers foundrymen convincing reasons why they should use Truline Binder in core sands. Savings in both man-hours and material costs are obtained in producing quality castings.

Iron shops using Truline for gravel and black sand cores report as high as 50 per cent reduction in shake-out and baking time. The high baked strength tends to eliminate core breakage. In some cases, iron foundries have successfully used Truline in a mixture of half heap sand with new, for medium and large core work.

Truline gives faster and more uniform baking—smoother, cleaner casting surfaces. Steel shops report its high efficiency in core facing sands, backing sands, and pouring cup mixes. Truline is equally effective for skin dry and dry sand molds. It has high resistance to moisture pickup.

Let us give you the up-to-date story on how Truline can help you save time and money.

BAKES OVERNIGHT—Iron shops solve baking bottlenecks by using Truline. This core was baked thoroughly in one night at 400°F.—halving the time required with other binders.

COLLAPSES QUICKLY—Truline helps prevent cracked castings, even where thickness of metal sections varies from one and one-half inches to eight, because cores collapse easier.

Naval Stores Department
HERCULES POWDER COMPANY
INCORPORATED
912 Market St., Wilmington 99, Delaware

NF54-2

ACCURATE

MULTI-CAVITY DUMP BOX

UNIFORM IMPRESSIONS...LOWER COST

The 8 gang dump box shown in this unretouched photograph was made from the single wood master core plug and backing frame. The same method may be used for two part split or booked type core boxes with flat or irregular partings. Added savings plus greater accuracy are assured when properly cleared white metal or aluminum master dryer patterns are also made by this same process.

There is real profit in this idea for you. Hundreds of foundries are now using this modern streamlined method of making core boxes and master dryer patterns because it is accurate, saves machining and offers large savings in the more intricate and gang type core boxes.

By Air Freight, Parcel Post, Special Delivery or Railway Express. Pick-up and delivery by jobber representatives in the following areas . . .

AUBURN, MASS.
Henry A. Kottmann
Telephone: Auburn 2683

MILWAUKEE, WIS.
John M. Donohue
Telephone: Hilltop 2-7130

DETROIT, MICH.
Harry H. Brown
Telephone: Midwest 4-8300
(Res. Birmingham, Mich.)

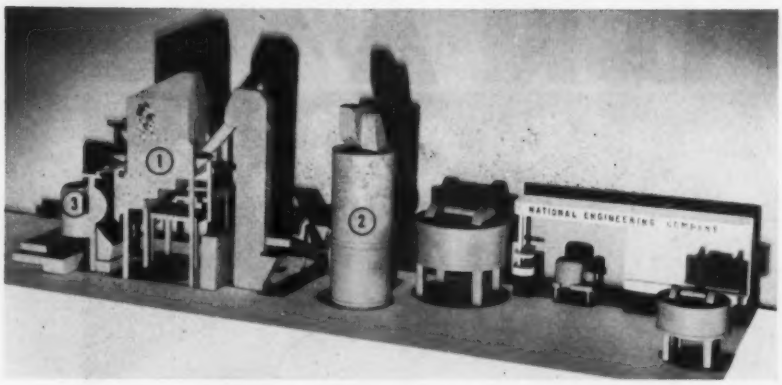
LOS ANGELES, CALIF.
McGowan Company, Inc.
Telephone: Trinity 2057

Write for Catalog

ACCURATE MATCH PLATE COMPANY

Exhibits Preview

continued from page 187



242. Reclaim Waste Sand for Core Use

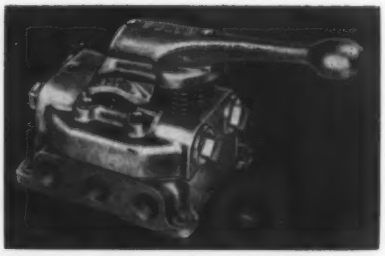
Waste sand—supplied by two Cleveland foundries will be reclaimed, rebonded and returned to those foundries for reuse in cores—all by National Engineering Company equipment to be on display in the company's operating exhibit at the Foundry Show. Equipment to be used in sequence of operation, will be: National Sand Recovery Unit, National Hydro-Filter, and No. 1 Model F Simpson Mix-Muller. Also on display will be the new F series of Simpson Mix-Mullers.

243. Electric Hoist

One of the products being displayed by "Shaw-Box" Crane & Hoist Div., Manning, Maxwell & Moore is their two-speed Series "700" 'Load Lifter' Electric Hoist. This hoist has a fixed slow constant speed, regardless of load, one-third as fast as its fast speed, and provides the constant slow creeping speed so necessary in foundry work.

244. Refractory Gun

A new, compact pneumatic refractory gun designed to reduce the cost of many time-consuming hand-applied refractory jobs will be shown by Vibron Div., Burgess-Sterbentz Corp. In addition the Vibron Bantam makes it possible to apply refractories with 40 to 50 per cent less moisture and thus produce longer-lasting refractory linings or patches.

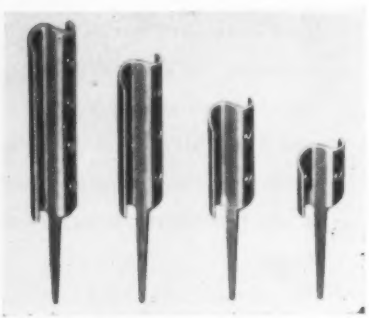


245. Air Control Valves

A variety of new air control valves comprising recent additions to the thousands of models made by Ross Operating Valve Co. will be shown.

246. Grinders

Rotor Tool Co. will show a complete line of new 4, 6, and 8 in. grinders at the AFS Foundry Show in Cleveland, May 8-14. The Rotor D-4 grinders feature one piece spindle supported by three bearings—front bearing is wider than usual to give more bearing surface on spindle and longer life. All bearings are double shielded, it is claimed.

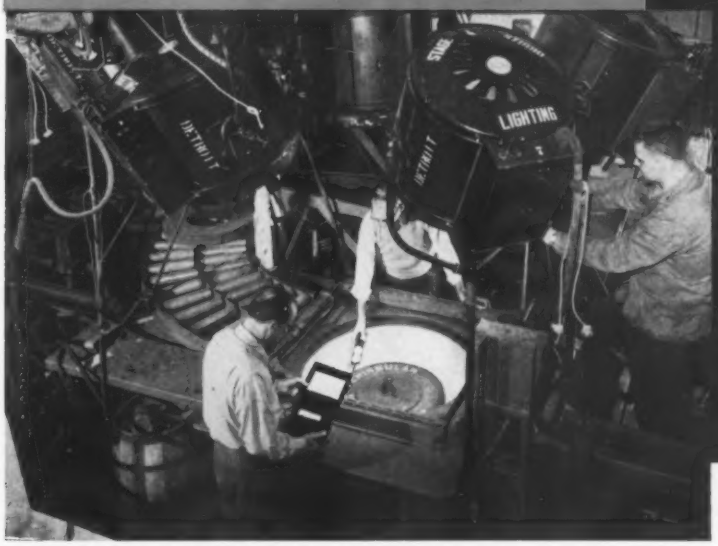


247. Fan-S-Chills

Fanner Manufacturing Co. will exhibit the Fan-S-Chill at the AFS Foundry Show in Cleveland. The chill, through its curved "S" design offers 75 per cent more chilling surface with less weight since there is no solid mass, it is pointed out. It is made of formed steel.

continued on page 205

Prevent accidents!...See "PLAY IT SAFE"



ACTION-PACKED FULL-COLOR SOUND FILM!

These 8 lamps, totaling 80,000 watts, are focused on a grinding wheel. The wheel, speeded until it bursts, is filmed for "Play It Safe" in slow motion, at 6000 frames per second.

First showing at
Foundry Congress Show May 8-14

See it at
Peninsular Exhibit, Booth No. 1023

Produced for the Peninsular Grinding Wheel Sales Corporation, in the interests of the steel and foundry industries, by the Jam Handy Organization.

Now, for the first time, see, in slow motion, an abused grinding wheel, rotating at high speed, burst into a thousand fragments.

Prevents accidents.—"Play It Safe" is an object lesson in the kind of handling, storing and mounting, and proper speeds, which prevent accidents.

65 years of safety know-how.—All Peninsular's grinding-wheel experience since 1889—has gone into "Play It Safe." This 20-minute motion picture drives home safety lessons viewers can't forget.

"PLAY IT SAFE"

will, we are sure, greatly benefit your personnel. **Be sure to see "Play It Safe"** at the Foundry Congress Show—and put in your request for showings of "Play It Safe" at your plant.

PENINSULAR
GRINDING WHEEL SALES CORPORATION
Plant and General Offices: 729 Meldrum, Detroit 7, Michigan

INDIVIDUALLY PENINSULAR ENGINEERED
SINCE 1889

SPECIALISTS IN RESINOID AND VITRIFIED BONDED WHEELS

600 TONS PER HOUR...

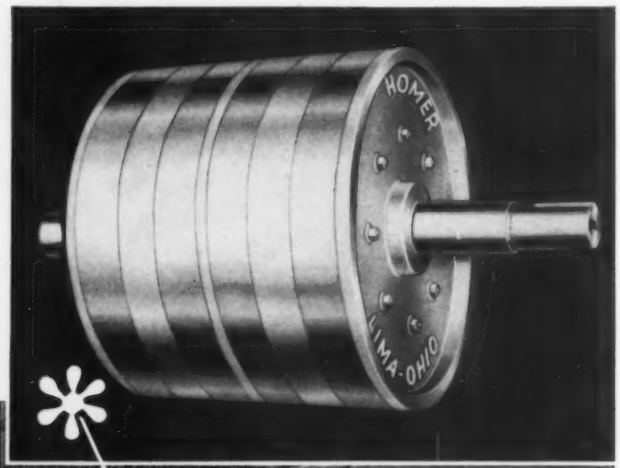
is a tough test- even for *the Best!*

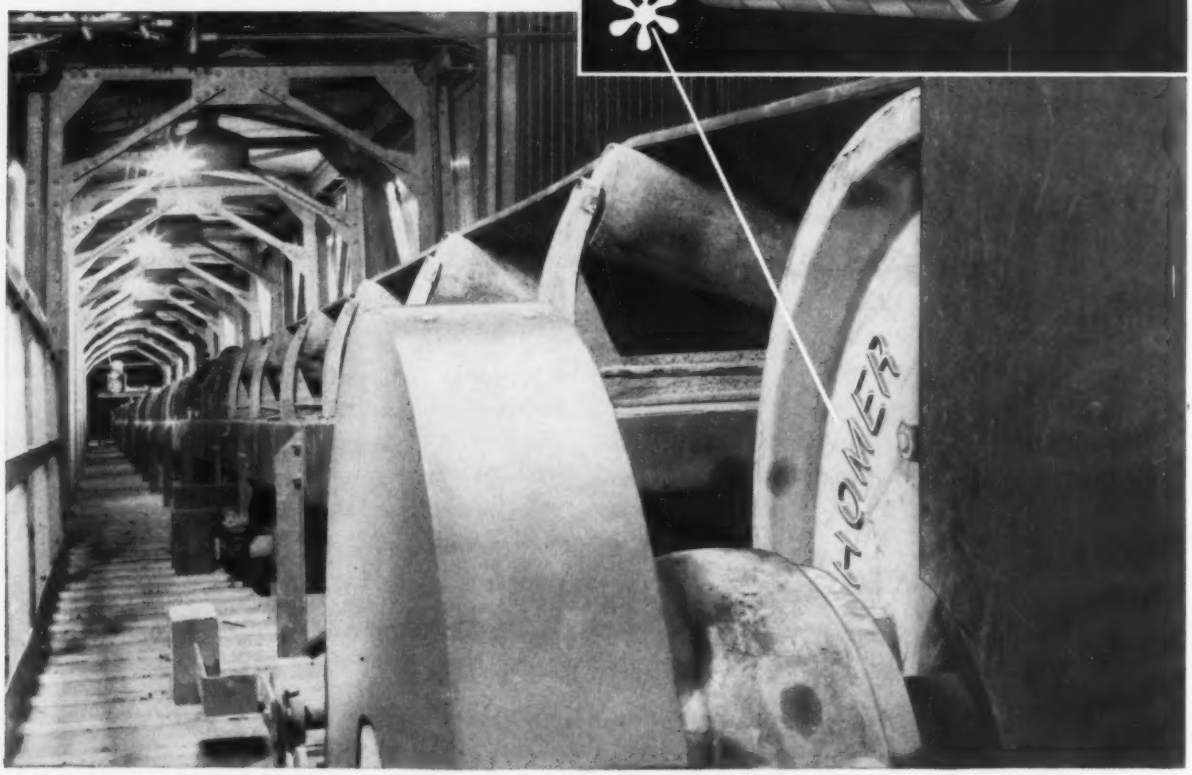
Yes—Homer permanent magnetic pulleys and Homer cross belt magnetic separators are pacing Alcoa's tough conveying and automatic tramp iron removal jobs at their Mobile, Alabama plant.

Lower photo shows Alcoa's 42″ x 36″ Homer heavy duty permanent magnetic pulley installation, one of the world's largest. This Homer pulley drives the 200′ long, 20% troughed slope conveyor, which travels 300 feet per minute, moving bauxite ore at the rate of 600 tons per hour. Slope on the conveyor is 3⅛′ per 12′ length. This is one of nine Homer magnetic conveyor units installed in this plant.

Like ALCOA – HOMER is interested in offering industry only the finest. Homer permanent magnetic separators have proved their ability time after time to perform effectively and efficiently, far beyond normal requirements.

If you are planning to use automatic magnetic separation equipment, it will pay to get the facts on Homer Magnetic Separators . . . the separators designed and built to give years of profitable service under unusual and extreme conditions. Let HOMER help solve your tramp iron problems – write us today. The Homer Manufacturing Co., Inc., Dept. 249, Lima, Ohio.





Remember... with a HOMER... you are *Certain!*

HOMER

...OR SMALL

We make them All!

INTERNATIONAL MOLDING MACHINE COMPANY

LA GRANGE PARK, ILLINOIS

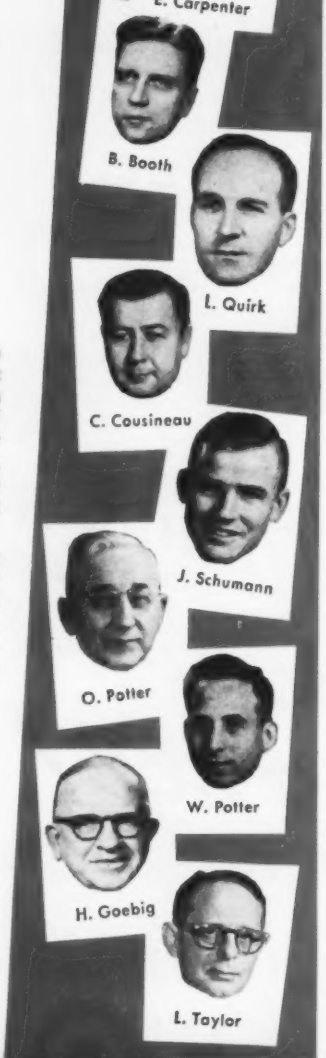
The International Line is designed by experienced foundry engineers who have a practical working knowledge of the problems of the industry.

"There is an INTERNATIONAL for Every Type of Job"

All of us want to meet YOU!

Booth 801, North Hall will be the Hardy Sand Company's headquarters at the 58th Annual Foundry Convention at Cleveland, May 8th to May 14th. All of us will be there to meet you, to answer your questions about Hardy Foundry Sand, Mold-Rite, Refract-O-Mold Spray, Big Horn Bentonite, and to show you the interesting exhibit we have prepared.

If you can't be at the convention we'd like for you to know that each order of Hardy Sand is laboratory controlled through it's production to meet requirements for grain, distribution, permeability, clay content, strength and moisture. We invite your inquiries.



REPRESENTATIVES

Wisconsin, Minnesota, Western Michigan —Carpenter Bros., Inc., Milwaukee.
Chicago—Goebig Mineral Supply Co.
California—Grant & Co., Los Angeles
Western Canada—Shananan's, Ltd., Vancouver, B.C.

All other states handled direct from Evansville, Indiana.

Producing controlled foundry sands for almost fifty years.

HARDY SAND COMPANY

POST OFFICE BOX 476 EVANSVILLE 3, INDIANA

F. E. F. Meeting

continued from page 197

Castings deliveries were approximately 17½ million tons in 1953, a nearly 5 per cent rise, and about 15 per cent better than the average of the three post-war years of 1946-47-48. Last year was exceeded only by the record 1951 total of 19¼ million tons, Mr. Gude pointed out. Along with this good year, 1953 saw a shrinkage of backlogs, he said, a situation not peculiar to the foundry industry. He reviewed recent developments in equipment, materials, and processes and concluded that foundries of the future will feature increased application of engineering and scientific treatment to foundry problems.

Visual aids were discussed by several educators. Prof. R. H. Cole, Northwestern University, cited the value of motion pictures for illustrating operations too large or too specialized for school foundries and said there was a dearth of such films. Some operations do not require motion, he pointed out, and showed a picture sequence he had made in an industrial foundry to illustrate key steps in making a large mold.

Prof. Warren C. Jeffery, University of Alabama, said visual aids are useful for handling increased teaching loads without additional staff. He illustrated this with several movie sequences he had made, indicating that the films also were useful for presentation before high school and club groups. He suggested that FEF act as a clearing house for exchange of educational slides and proposed the Foundation schools cooperate in making general interest movies and special instructional sequences.

Advanced Students Used

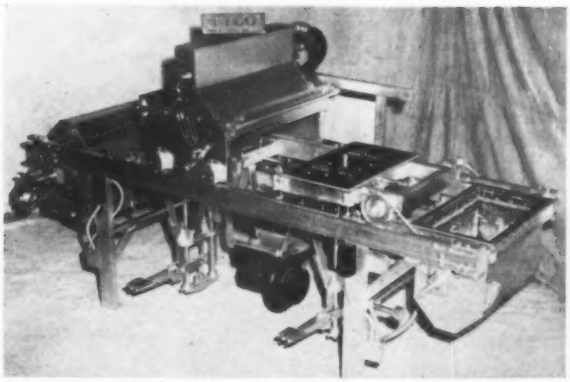
Advanced foundry students are used to set up demonstrations for elementary students at Cornell, and are also used on minor investigations, Prof. P. E. Kyle reported. The AFS high temperature sand research project is a valuable educational activity and is carried on with the aid of top FEF scholarship students, he said. Visits by the Central New York Chapter of AFS are helpful, he added.

Prof. C. E. Bullinger, Pennsylvania State University, said curriculum revisions should be made to keep abreast of industry and suggested inclusion of techniques for making management decisions and for inquiring into problems.

The first session on university activities concluded with a showing of a Steel Founders' Society film on application and design of steel castings given to FEF by American Steel Foundries.

Research should be of direct interest to industry wherever possible, Prof. D. S. Eppelsheimer, Missouri School of Mines, said, to repay industry for its support. He had found such a problem in the AFS·College Research Projects

continued on page 221



248. Shell Molding Machine

Tyler Metal Products Co. will have in operation throughout the Show a Tyco Shell Molding Machine. Of the many new features incorporated in the Tyco Shell Molding Machines, three outstanding improvements are pointed out; Semi-Automatic, Hot Air Curing Oven, and Quick Pattern Plate Changing.

249. Turnover Molding Machine

British Moulding Machine Co. will feature the BT.5 Turnover type Molding Machine, as one of two units to be exhibited, at the Foundry Show. The unit is equipped with automatic Jolt Timer, pneumatically operated Swing Arm and a completely automatic system of removal. As soon as the machine is inverted the gravity conveyor swing gate is automatically lowered and then as the pattern draws clear of the mold, air is supplied to the cylinders on the squeeze head with the result that the head rollers are inclined and the mold rolls away without any assistance from the operator.

Exhibits Preview

continued from page 192

250. Tractor Shovel

Visitors at the Foundry Show will have an opportunity to preview operating advantages of the new hydraulically-actuated 12 cf Load-Plus tractor shovel developed by the Jaeger Machine Co. Performance features claimed are: bigger lifting capacity, faster speeds, shortest turning radius, highest dumping clearance, and longest reach.

251. Electric Resistance Furnace

One of the units to be exhibited by Lindberg Engineering Co. will be the Lindberg-Fisher Electric Resistance Furnace. It is designed for melting and holding aluminum, magnesium, lead, zinc and other white metals. The furnace is heated by resistance elements mounted on the side walls of the refractory lining to achieve uniform distribution of heat.

continued on page 206

Exhibits Preview

continued from page 205

252. Shake-Out

A six by eight ft Simplicity Simpli-Flo Spring Mounted Shake-out will be one of the items displayed by Simplicity Engineering Co. at the AFS Foundry Show in Cleveland. The unit has a safe load capacity of up to 15 tons or can be used for handling much lighter flasks of larger area, it is claimed. Also shown will be a three by eight ft light type, vertical action, spring mounted shake-out; a two by five ft Os-A-Veyor type spring mounted feeder; and a 20 ft long Model No. 32 Positive Action Conveyor in connection with an overhead magnetic separator.

253. Shell Molding Machine

Shallway Corp. will feature the Shalco Shell Molding Machine, a manually operated unit for the making of phenol resin (shell) molds, at the AFS Foundry Show. The resin and sand mixture is applied to the heated patterns by closing the patterns over the dump box and making a 180° turn, thus dropping the material evenly on the pattern plate. Investment operation takes about eight seconds. Upon completion of this function the pattern is returned to a horizontal position and the oven is placed over it for final curing of the shell.

254. Sand Conditioner

The Moulders' Friend will display the new Moulders' Friend sand conditioner with piler conditions and carries to a stationary molding machine on a typical foundry floor five tons of thoroughly conditioned sand in ten minutes. The flat tempered steel wires of the rapidly rotating brush condition the sand as the machine travels from the gangway to the rear of the heap. At the rear the machine reverses direction, and the brush once again conditions and throws 1,200 lb of sand into the bucket attachment.

255. Telecrane

The MSA Telecrane FM Carrier Communication System will be featured by the Mine Safety Appliances Co. at the AFS Foundry Show in Cleveland, May 8-14. The Telecrane helps coordinate operations, speeds production, promotes safety and reduces delays in materials handling, company engineers explain. Clear, direct voice communication, audible above the noise level of plant operations, is achieved, they add. It is free from transmission noise and interference. No new or additional wiring connections are needed; it employs existing electrical circuits for transmitting carrier waves. A coupling capacitor joins the carrier frequency to any AC or DC power line.

continued on page 207

Exhibits Preview

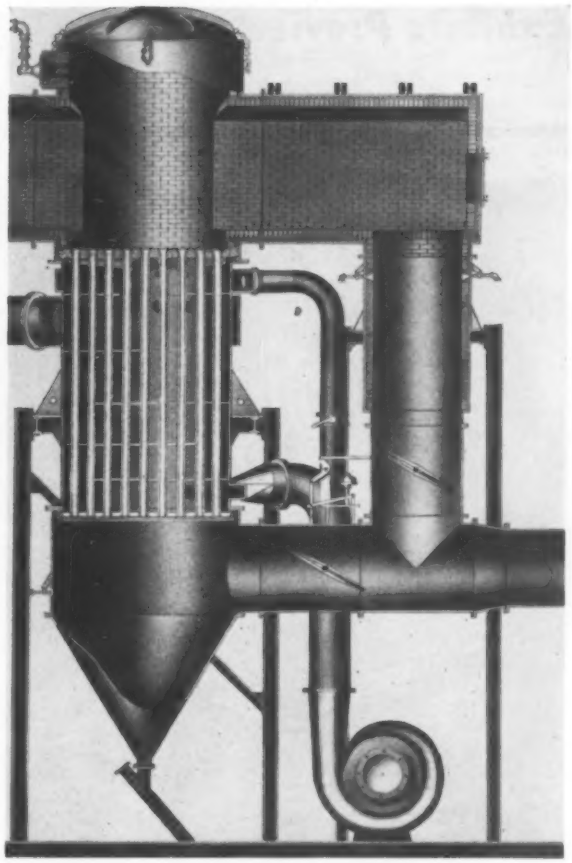
continued from page 206

256. Hydraulic Telecrane

Austin-Western Co. will show its new indoor-outdoor Hydraulic Crane. Combining the best features of crawler, truck and erection cranes with those of industrial shop cranes, the new machine is self-propelled and hydraulically operated. Four functions are involved: turntable rotation, boom elevation, raising and lowering of cable and hook, and power extension and retraction of the boom. All movements, are actuated by hydraulic power.

257. Complete System

A complete working system actually handling castings and sand will be seen at the Link-Belt Co. exhibit at the 1954 Foundry Show. A 25-ft "PA" oscillating conveyor will handle the castings and sand; screen will be used as part of the conveyor trough to separate the sand from castings. A 25-ft belt conveyor will recirculate the sand through the system while another oscillating conveyor will recirculate the castings.



259. Heat Exchanger

Grindle Corp., will exhibit illustrations of their various products now available for melting, casting, heat treating, and air pollution corrective equipment at the Foundry Show. The Grindle Heat Exchanger has been adapted successfully, it is claimed, to the heating of cupola blast air. This "hot blast" heat exchanger utilizes waste gas from the cupola (recuperative type), or it may be fired direct with oil, gas or pulverized coal. Various phases of the melting and stack gas purifying problems will be explained and demonstrated at the Show by Grindle.

continued on page 208

258. Aluminum Alloy

Federated Metals Div., American Smelting & Refining Co., will demonstrate the anodizing of Tenzaloy. Tenzaloy is a high-strength aluminum alloy of the aluminum-zinc-magnesium type developed to meet foundry needs for an aluminum alloy that will age at room temperature and still produce mechanical properties equivalent to those normally obtained by solution treating, quenching, and artificial aging. No special technique is required.

Exhibits Preview

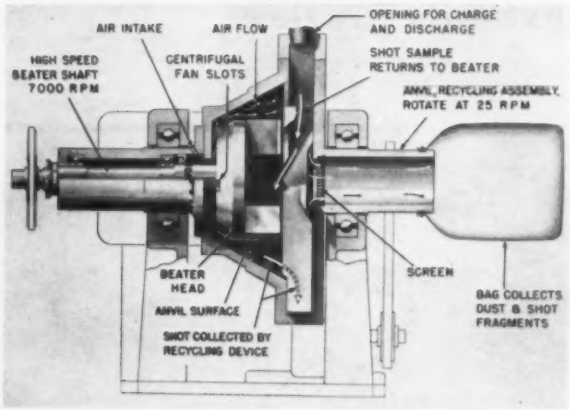
continued from page 207

260. Blastmaster Rotoblast Barrel

A blast room featuring the 27 cu ft Blastmaster Rotoblast Barrel will be featured at the Pangborn Co., exhibit at the AFS Foundry Show in Cleveland, May 8-14. One of the features of the barrel is its abrasive-tight door. The door is of all metal construction laminated with a rubber back to protect it from flying abrasive. Its side edges have rollers which travel in a mechanical labyrinth. The door moves up and down like a window curtain, easily operated by a crank which winds or unwinds the roller.

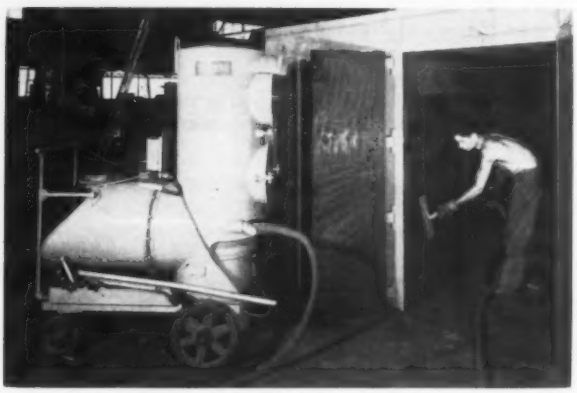
261. Cutting Wheel

Bay State Abrasive Products Co. will display their new BZ Saf-T-Cut wheel at the AFS Foundry Show in Cleveland, May 8-14. Greater safety, coolness, life, strength, cutting speed and resistance to loading is claimed for the wheel. Wheel is available in Aluminum Oxide abrasive, for cutting metals and Silicon Carbide abrasive, for cutting non-metallic materials. It is reinforced with tough glass fiber. Microphotograph shows wheel.



262. Test Machine

Alloy Metal Abrasive Co. will show the Ervin Test Machine at the AFS Foundry Show. The machine duplicates the conditions as they exist in production. It propels the abrasive against a casting at the rate of approximately 200 fps, returns it to the throwing wheel by means of an automatic recycling device until it is worn out, and counts the number of times that the abrasive is thrown. The machine is currently being used in Europe for research work.



263. Vacuum Cleaners

The Spencer Turbine Co. will feature portable and stationary vacuum cleaners for cleaning core ovens, overhead steel work and many other applications in foundries, at its exhibit at the AFS Foundry Show.

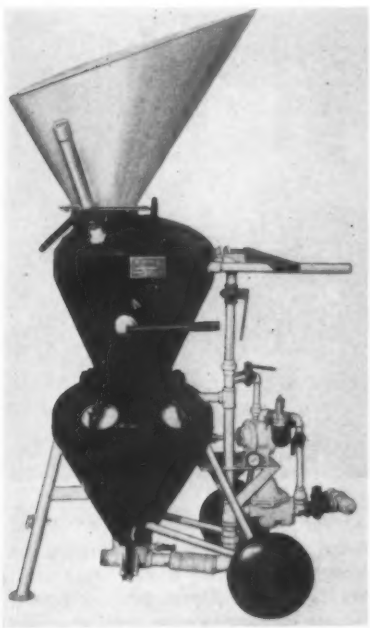
continued on page 209

Exhibits Preview

continued from page 208

264. Printweight Scale

Toledo Scale Co. will feature the new Toledo Printweight, representative of their recently announced new industrial line, at the AFS Foundry Show in Cleveland, May 8-14. The Printweight, now available for practically all Toledo dial type scales including portable, bench, floor and motor truck scales, eliminates costly human errors that can originate in reading, remembering and recording weight figures, it is claimed.

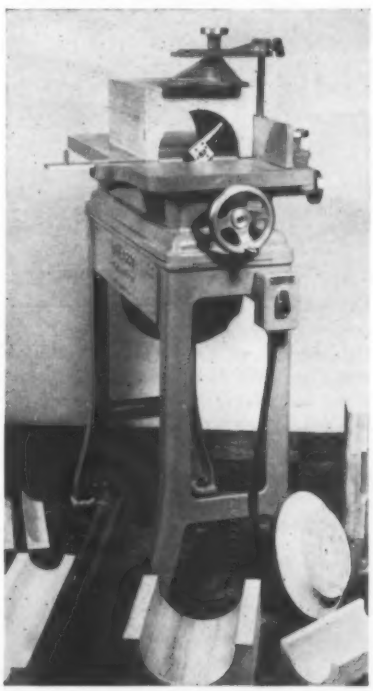


265. Blastcrete Gun

Blastcrete Equipment Co., will show the Blastcrete Gun for the gunning of refractories. The unit has the ability to shoot materials with moisture content up to 6 per cent.

266. Air Grinder

Master Pneumatic Tool Co., Inc., will display at the AFS Foundry Show a Master Power Vertical type Portable Air Grinder. It is shown removing excess metal on an automobile cylinder block.



267. Core Box

Glover Manufacturing Co. will feature a core box and fillet machine in operation at the AFS Foundry Show. Elbow, straight, ring and irregular core boxes and fillets, can be made on the machine. It will make core boxes, from 11/16 in. to 6½ in. in diam. and fillets, from 11/32 in. to 3¼ in. Elbows and rings with pivoting radiuses up to six ft. can be made.

268. Binders & Additive

American Colloid Co. will exhibit Volclay, a Western Bentonite; Panther Creek, a Southern Bentonite, and Five Star Wood Flour, at the AFS Foundry Show in Cleveland May 8-14. Volclay is added to foundry sands to furnish green dry, and hot strengths. Panther Creek requires about the same addition as when Volclay is used, yet the dry and hot strengths are much lower, it is claimed. More foundrymen, it is stated, are finding that a ¼-2 per cent addition by weight of Five Star Wood Flour offers better sand mixtures.

269. Mounting Pads

Fabreeka Products Co. will feature Fabreeka Pads for Shakeout Machines and Fabreeka Mountings for molding machines at the Foundry Show. Pads are used to prevent breakage of machine parts, keep bolts tight, reduce noise and transmission of vibration to other machines and other parts of the building, it is claimed.

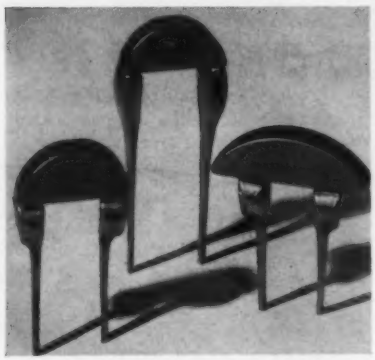
270. Slag-Disposal Unit

American Conveyor Co. will exhibit the American Portable Slag-Disposal Unit at the Foundry Show. The unit eliminates costly pits, foundations, troublesome recirculating pumps and installation, it is claimed. Being fully portable, it can be moved or alternated between cupolas. Unit is capable of handling slag, produced by cupolas melting from five to 25 tons per hour.

continued on page 210

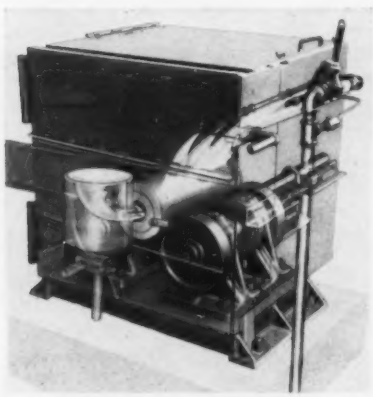
Exhibits Preview

continued from page 209



271. Spider Chill

Standard Horse Nail Corp. will feature the new Koolhead Radius Spider Chill at the AFS Foundry Show. Claimed to combine many features not obtained in any other type of chill unit, it was designed for the casting industry to meet many applications.

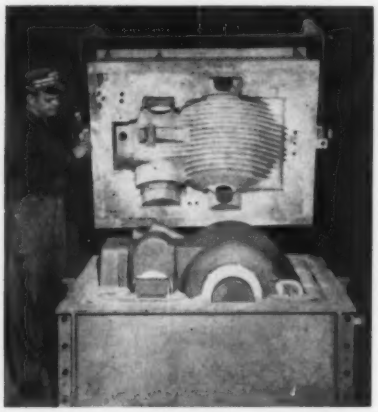


272. Casting Machine

Centrifugal Casting Machine Co., will feature a water cooled centrifugal Casting Machine. They are made in six different sizes.

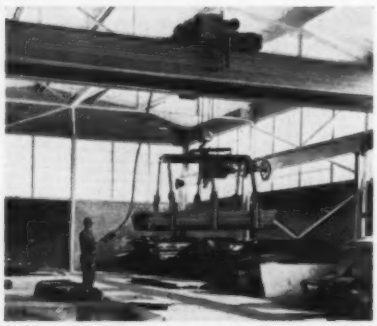
273. Process Control

The theme of the Magnaflux Corp. booth at the AFS Foundry Show will be "How to Use Process Control in the Foundry." They will demonstrate this by using their Stresscoat as a design tool on sample castings and by showing with their non-destructive tests, Magnaflux, Magnaglo and Zyglo, the effects of certain types of defects with relation to their severity and location and how both of these are used to reduce scrap.



274. Plaskon Resin

Barrett Div., Allied Chemical and Dye Corp., will feature a core made with Plaskon 580-11L Resin and the poured casting. Casting specifications include pressure testing, physical and chemical determinations.



275. Overhead Crane

Cranemaster series of industrial shop cranes in capacities to 15 ton will be the feature of Abell-Howe Co. Four standard models, offered to suit headroom requirements or varying building conditions will be explained.

276. Core Binder

Specialty Products Co. will feature Kore-Set OH core binder at their exhibit at the Foundry Show. Kore-Set OH is a plastic sand core binder which combines the features of conventional core oils and conventional phenolic resins, in one product.

277. Fork Lift Truck

Buda Co. will exhibit the Buda Model FT40-24 Fork Lift Truck at the AFS Foundry Show in Cleveland. Features claimed, include added leg room due to location of the controls; all controls for lifting are easily accessible in front of the operator, and shift on steering wheel makes for easy operation of the vehicle.

278. Tool Package

Bedford Tool and Forge Co. and Lobdell United Co., have combined their exhibit at the Foundry Show to offer a Tool Dressing Package. The prepared "Package" of equipment and supporting data, includes all of the forging, heat treating and dressing equipment, plus methods needed for operation.

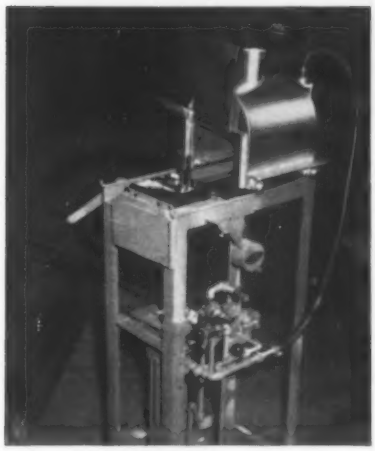
279. Cold Coating Process

Acme Resin Corp. will display its recently developed cold coating process for sand. Developed originally for use in blowing of cores and shells, the process is now adapted to dump or roll-over operation in most cases, it is claimed. High strength at very low resin content, dust-free operation and no segregation are advantages claimed for the new process.

continued on page 211

Exhibits Preview

continued from page 210



280. Shell Molds and Cores

Gladwin Corp. will exhibit the Gee Machine at the AFS Foundry Show. The machine is being used for producing shell molds and shell cores and some machines are being used by resin manufacturers in their laboratories, which enables them to systematically test each blend of raw material and each step of the process under laboratory controlled conditions.

281. Tool Grinder

Standard Electrical Tool Co., will display its new 30 in. Single Wheel Wet Tool Grinder. It features vibrationless operation. The two-speed multiple V-belt drive from 5 hp motor to grinding spindle is versatile and efficient, and a safety interlock prevents overspeeding of grinding wheel.

282. Sand

In addition to mold sand and core sand, Pennsylvania Glass Sand Corp., will exhibit Penn-Sand products which include shell molding sand, silica flour and sandblasting sand.

283. Shell Molds

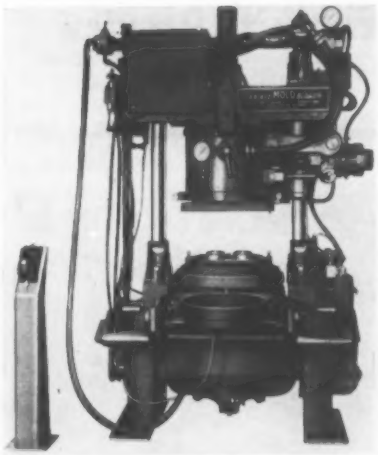
Many examples of various sizes and shapes of shell molds and cores will be exhibited at the Durez Plastics & Chemicals booth. Accompanying these will be actual castings made in duplicate molds and in a wide variety of metals.

284. Moldable Compound

Foundry Services, Inc., will show castings made with and without a moldable, exothermic FEEDEX sleeve. The photo on the left, above, is without FEEDEX and the casting at the right is with it. The product will be demonstrated at the exhibit.

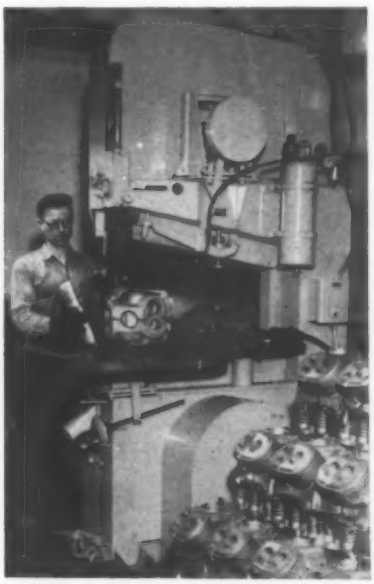
285. Payloader

Model HA "Payloader", will be featured by the Frank G. Hough Co. at the AFS Foundry Show in Cleveland. Models HAH, HE and HF "Payloader" Tractor Shovels will also be on display. The Model HA can be used to handle used sand, charcoal briquets, fire clay, cores, castings, patterns, sprues, scrap and many other materials. It is particularly suited to fast digging from stockpiles because of special bucket design and a double crowding action of the bucket. This combination makes it possible to pick up full loads quickly and easily and to retain them without spillage.



286. Mold Blower

The new San-Blo Mold Blower, Model 150, will be introduced by the Federal Foundry Supply Co. at the Foundry Show. It makes use of the same exclusive features that distinguish the San-Blo line of core blowers —"Cyclo-Air" blow head and "LLP" (low pressure prefill). The fully automatic machine, easily operated by one man, will blow cope, drag or stack molds weighing up to 150 lb.



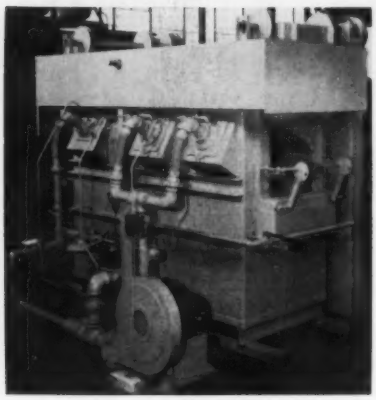
287. Band Saving

New machines for more effective band sawing and band filing of castings is the theme of the DoALL Company's exhibit at the Foundry Show. Visitors will have the opportunity to see a new, completely hydraulic, heavy duty band machine, Model 26-3, cutting through engine blocks with ease.

continued on page 212

Exhibits Preview

continued from page 211



288. Melting Furnace

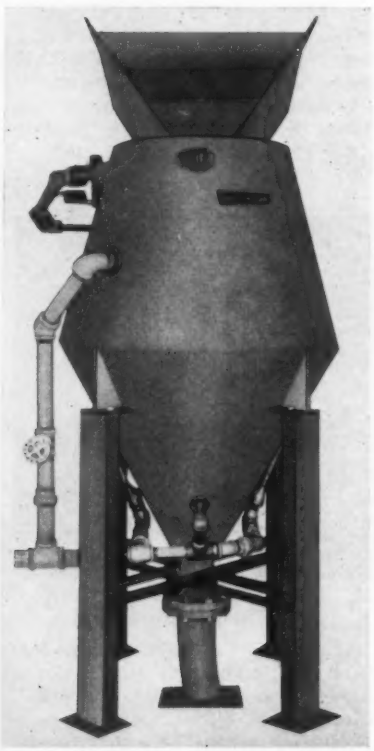
Stroman Furnace & Engineering Co., Div., Petersen Oven Co., will show the Stroman Double Chamber "DC" Aluminum Melting Furnace at the AFS Foundry Show. The furnace is developed to meet known conditions and peculiarities of the alloys regardless of how it is cast either in sand, permanent mold, die cast, or reclamation, it is pointed out.

289. New Type Packing

E. F. Houghton & Co. will demonstrate VIM No. 1243-3 Rubber Impregnated Leather Packing at the AFS Foundry Show in Cleveland. The packing, it is pointed out, is being used to excellent advantage on mold vibrators. It combines the strength of leather and the non-porosity and resilience of rubber.

290. Furnace Lining

National Half Ring Furnace Lining and accessories will be featured by National Crucible Co. at the AFS Foundry Show. Lining can be furnished in either Silicon-Carbon or Mullite Material and was developed for simplicity and speed.

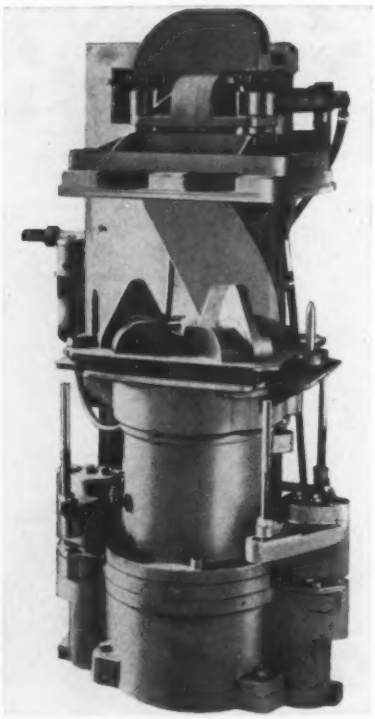


291. Sand Moving System

One of the items to be featured by Whirl-Air-Flow Div., Gerwin Industries, Inc., at the Foundry Show will be the Transporter. This is one of the three main components of the Whirl-Air-Flow Pneumatic sand moving system. Push-button control of the system is possible from a central operating panel.

292. Air Hoist

Ingersoll-Rand Co. will exhibit Air Tools for foundry use, featuring "Air Engineering" as the modern way to faster production. Several sizes will be connected to the air supply so that visitors can operate the equipment while attending the show.



293. Jar-Squeezer Machine

Tabor Manufacturing Co. will show a new flask lift molding machine that jars and squeezes simultaneously. This function promises higher conveyor line production in the foundry. Total time required from rolling on a flask to striking of a finished mold requires only 10 to 15 seconds, it is claimed, even when the flask is deep and the mold is difficult.

East Coast

continued from page 149

at some length on non-ferrous applications of the problem. He declared that the introduction of oxygen into melts had produced better results in copper alloys. A concomitant problem is the elimination of hydrogen. Controlled melts, he believes, will produce sounder castings with fewer feeding difficulties.

At the noon luncheon, W. D. Bryden, Philadelphia Bronze & Brass Corp., was chairman. He introduced F. B. Rote, Albion Malleable Iron Co., Albion, Mich., who spoke on "Quality Control in the Foundry." A control program, Rote stated, develops better standard castings in a production operation and reduces foundry costs. It is vital, he said, that the plant detect scrap before the customer does.

Management must determine its philosophy for quality control and provide the necessary control authority. Standards of quality must be set, commensurate with the economy of the times. Casting defects are usually definable by types: 1. minor but machinable and salable; 2. minor but salvageable; 3. major scrap.

An effective quality control program must find defects at the earliest possible stage of production to reduce investment in scrap. Rote described steps taken in his plant to insure effective control. The quality control man must be a foundryman first, he stated, a statistician second. In any event, plant standards must exceed those specified by the customer.

A series of five round-table group meetings were held during the afternoon on the economics of good melting practice. The sessions were grouped by interests: aluminum and magnesium, brass and bronze, gray iron, malleable, and steel.

Aluminum Spokesman

D. L. LaVelle, American Smelting & Refining Co., was discussion leader for the aluminum and magnesium session, opening with remarks on gas porosity and melting practice. The purging of heats by use of nitrogen, chlorine, and pills was discussed. Gas porosity tests, including the vacuum bell jar procedure and sample machining were reviewed. Jobbing foundrymen agreed that they would have difficulty using completely degassed aluminum. However, since this material shrinks like aluminum bronze, emphasis was placed on careful handling of aluminum in the molten state and the dangers of overheating were pointed out.

Meeting co-chairman, E. V. Lanfranke, V. P. Rolle Mfg. Co., mentioned the excellent results obtained at the Volkswagen plant in West Germany with induction melting of light alloys. He had visited the plant, noted that porosity-free castings were obtained without fluxing or purging the heat in induction furnaces. Although initial investment is high, melting cost is roughly two-thirds that of conventional methods.

The brass and bronze round table meeting was conducted by discussion leader H. C. Ahl, Jr., Down River Casting Co., Rockwood, Mich. He prefaced the open meeting by discussing risering and melting of brass and bronze. Questions were raised about the checking of combustion gases with old crucibles, just before they are renewed. Scrap vs. ingot was argued for some time, and the session concluded with a summation of the practical value of fracture tests to the brass and bronze foundryman.

Scrap Affects Gray Iron

Type of coke and scrap used make a considerable difference in gray iron melting, according to Harry Kessler, Sorbo-Mat Process Engineers, St. Louis. He led the discussion on gray iron melting, where the question of a basic lining for cupolas was also raised. It was remarked that, although initial cost is high, different analyses of iron could be melted, more scrap could be used, and higher carbon recovery is possible. Improper fluxing will cause less refractory damage with basic lining, it was stated, and fluxing was recommended at the start of a melt rather than on in-between splits.

Discussion leader J. H. Lansing, Malleable Founders' Society, Cleveland, reviewed melting practices for malleable iron before opening his group meeting to the floor. Immediately, the question of additives in the melt became a heated topic for audience participation. Other subjects raised during the discussion period included labor and material costs in melting, refractory costs, and batch type and duplex melting practices.

Steel round table discussions were led by C. E. Sims, Battelle Memorial Institute, Columbus, Ohio, who opened his session with a concise summation on the various types of steel melting. The electric furnace, he remarked, gave better control and was more economical to operate. He discussed the cupola converter, open hearth furnace, and electric furnace in steel melting. The electric, while using more costly fuel, has a somewhat lower overall production cost.

The electric furnace, Sims said, is the most versatile, uses less desirable scrap, gives faster melt, and can cut oxidizing characteristics in slag. High sulfur content in the cupola and open hearth comes from the fuel, a disadvantage not present with the electric furnace.

Sims also pointed out the advantages of the open hearth and cupola converter methods. But, he concluded, the electric furnace offers definite opportunities for quality melting of steel for casting.

Humorous Economics

John J. Davis, former mayor of Reading, Pa., provided the highlight of the evening banquet. His was a humorous talk on "The Relationship of the Individual to Present Day Economics." A wit and a deftly entertaining banquet speaker, Davis kept the audience in a constant uproar with his repertoire of jocundity.

"Should I Adopt Shell Molding?" was the question put to the Saturday morning meeting by T. W. Curry, Lynchburg

continued on page 223

American Brake Shoe Co. has awarded for the first time a new president's safety trophy to its National Bearing Division plant at Meadville, Pa., for having the best safety record of all the company's 58 plants. The trophy was presented to superintendent Charles Ban (left) by new-retired Brake Shoe president, Maurice N. Trainer. The Meadville plant won the award by having only three reportable injuries in 826,077 man hours during the year, or an accident frequency rating of only 3.6 accidents per million man hours worked.

Information

continued from page 188

Palletier Fork Truck

Bulletin gives specifications and dimensional drawings on eight Palletier models, which have capacities of from 1,000 to 8,000 lb. Improved features illustrated include: safe, efficient control; an efficient driving unit; a powerful hydraulic system; heavy duty steel frame; anti-kick back steering, and a number of safety features, it is pointed out. *Barrett-Cravens Co., Crescent Truck Div.*

For more data, circle No. 303 on p. 188

Radiography

Booklet, "DuPont Products for Industrial Radiography," is a guide for x-raying such metals as steel, magnesium, and aluminum, with recommendations as to type of film and exposure for each. It provides exposure and processing data for each of the company's films used in industrial radiography. *DuPont Photo Products Dept., E. I. DuPont Nemours & Co.*

For more data, circle No. 304 on p. 188

Metal Chain

Bulletin No. 53-56 describes what Z-Metal Chain is and what it does. Features pointed out are: greater strength, abrasion resistance, corrosion resistance and longer chain life. Booklet also illustrates chains in various operations. *Chain Belt Co.*

For more data, circle No. 305 on p. 188

Cams and Crankshafts

Booklet entitled "Meehanite Cams, Camshafts and Crankshafts" devotes itself exclusively to application problems solved by Meehanite cams, camshafts and crankshafts. In addition, it describes briefly the basic metallurgy and chief important engineering properties of a few of the types of Meehanite metal most widely used for such service. *Meehanite Metal Corp.*

For more data, circle No. 306 on p. 188

Molding Machines

Catalog No. GC-11-53, "Let's Look at the Herman Line of Molding Machines," features the complete Herman line of molding machines; including Herman 750 and 1,500 lb jolt rollover machines, vertical hydrocentrifugal casting machines; indexing machines; and many others. *Herman Pneumatic Machine Co.*

For more data, circle No. 307 on p. 188

Industrial Equipment

Catalog MS-450-5310, Presenting the Allis-Chalmers Line," pictorially describes the company's newly revised general line. Catalog illustrates information and data on the HD-15 crawler tractor. Illustrated and described also along with its crawler tractors and wheel tractors and motor graders, is A-C's line of motor scrapers and wagons, and the expanded line of pull-type scrapers. A 10-page section is devoted to pictures and pertinent data on the selection of allied equipment and field-proved attachments. *Allis-Chalmers Mfg. Co.*

For more data, circle No. 308 on p. 188

Stainless Rings

Bulletin CC 54 takes you behind the scenes in the production of high alloy castings. Titled, "Our Hat's in the Jet Ring," it pictorially shows the production stages in stainless steel spun rings and also shows the various specialty aircraft castings produced in sand molds, permanent molds and shell molds. *Cooper Alloy Foundry Co.*

For more data, circle No. 309 on p. 188

Aluminum Alloy Castings

Bulletin No. 165, "Practical Help in the Casting of Aluminum Alloys," covers such subjects as effect of moisture, shrinkage, dross, pouring temperature, and test bars. They are discussed from the foundryman's viewpoint. *Federated Metals Div., American Smelting and Refining Co.*

For more data, circle No. 310 on p. 188

Improving Surface Finish

Technical Bulletin, File E, No. 2, deals with improving surface finish, eliminating defects in castings with Lite-Rock foundry grade perlite. Bulletin is based largely on excerpts from Preprint No. 52-21 published by AFS. *Ironton Fire Brick Co.*

For more data, circle No. 311 on p. 188

CASTING through the Ages
TO PREVENT COLONIAL AMMUNITION FROM BEING CAPTURED BY THE BRITISH
George Washington
VISITED PENNSYLVANIA'S ROCKBERRY FURNACE, SEPT. 17, 1777 TO MAKE CERTAIN THAT ALL CANNON AND SHOT WERE SAFELY HIDDEN.
As early as 1755,
SMEATON, FAMED BRITISH ENGINEER, REPLACED TIMBER STEAM ENGINE FITTINGS WITH CAST IRON—AND 27 YEARS LATER DEFENDED HIS JUDGMENT BY SHOWING THAT THE ORIGINAL PARTS WERE STILL PERFORMING THEIR WORK.
Odd Bits.
AFTER CASTING CANDLESTICKS CHAFING DISHES, SPICE MORTARS, AND SUCH ARTICLES, THE FOUNDERS OF EARLY 17th CENTURY LONDON WERE SAID TO "TURN THEM WITH THE FOOT AND NOT WITH THE WHEEL" TO MAKE THEM SMOOTH AND BRIGHT....
WHEN THE 400,000 ODD TON
Great Bell of Moscow
WAS CAST IN 1733, RUSSIAN NOBLEMEN JOURNEYED FROM THE EMPIRE'S FARTHEST REACHES TO TOSS INTO THE FURNACE, OFFERINGS OF GOLD, SILVER PLATE AND
JEWELRY!

1954 Foundry Congress Set For Florence, Italy

The twenty-first International Congress of Foundry Technical Associations will be held in Florence, Italy, September 19-26, 1954, at the premises of the Mostra Mercato Nazionale dell'Artigianato.

The Italian government will join with various technical societies in organizing the meetings. Exhibits of foundry literature, products, and technology will be held during the Congress. Following the close of the sessions, organized tours will be conducted throughout Italy.

The following associated events will be held concurrently with the Foundry Congress: historical foundry exhibition, including paintings, sculpture, drawings, and old photographs; exhibition of casting defects; scale models of working foundry installations and equipment.

All foundrymen interested in attending the 1954 Congress may obtain programs and information from AFS Headquarters, 616 South Michigan Ave., Chicago 5. Thos. Cook & Son have been designated the official travel agency by the Italian association. All post-convention tours will be arranged through this organization.

1953 Index Ready

The index to volumes 23 and 24, including all issues of AMERICAN FOUNDRYMAN for the period of January-December, 1953, inclusive, will be ready for distribution in May. The index includes a topical listing of all feature stories and departments carried in the magazine for the year, and an author's index for reference to individual writers.

Requests for the index should be addressed to the magazine at 616 South Michigan Ave., Chicago 5. There is no charge.

Announce Winners of Society Safety Contest

Malleable Founders' Society has announced the winners of its third annual Self Improvement Safety Contest.

This competition is sponsored annually to give recognition to plants in each of the several groups which have made the greatest reduction in accident frequency rate for the current year.

Each of the winning plants for this year reduced its accident frequency by 70 per cent or more. The average accident frequency rate for the 60 participating plants in th contest was 21.7, a reduction of 27 per cent from the 1952 figure.

The 1953 winners are:

Group I (less than 100 employees): Webster Mfg., Inc., Tiffin, Ohio.

Group II (100-199 employees): Chain Belt Co., Milwaukee.

Group III (200-399 employees): Texas Foundries, Inc., Lufkin, Texas.

Group IV (Over 400 employees): Terre Haute Malleable & Mfg. Corp., Terre Haute, Ind.

The twenty-first International Foundry Congress will be held in these beautiful facilities of Mostra Mercato Nazinonale dell'Artigianato in Florence, Italy, Sept. 19-26.

Aluminum Heat-Treating Manual Now Available

Reynolds Metals Co. has published a new manual, *Heat Treating Aluminum Alloys*, which contains a special, non-technical section on metallurgy involved. A second section, prepared for the metallurgist, contains full metallurgical details on wrought aluminum alloys, cast aluminum alloys, wrought alloy numbering system, and the temper designation system. Both heat-treatable and non-heat-treatable aluminum alloys are covered.

A chapter has been added on the heat treatment of cast aluminum products, fully explaining all factors which cause difficulty in this field. Tables are included, showing typical mechanical properties produced by various heat treatments of sand cast alloys, permanent-mold castings, and die castings.

The 122-page manual is a handy 6 x 9-in. pocket size, is ring bound to open flat. It is profusely illustrated and has three indexes for easy reference. Write for copies to Editorial Service, Reynolds Metals Co., 2500 South Third St., Louisville, Ky.

AFS Publishes New Molding Machine Manual

AFS National Headquarters has received its new publication, *Symposium on Molding Machines*, from the printer. It is being offered for sale at $1 to members of the Society, and $1.50 per copy to non-members, in accordance with the pricing policy established by the Publications Committee.

Sponsored by the AFS Plant and Plant Equipment Committee, the Symposium includes four papers that cover the application of machinery to the molding process. Illustrations add to its usefulness as reference material.

APPROXIMATE HOLDING CAPACITY OF CUPOLA WELL

Diameter Inside Lining, in.	Approximate Holding Capacity, lb
23	570
27	820
32	1160
37	1540
42	1990
45	2280
48	2610
54	3390
60	4050
66	4910
72	5840
78	6840
84	7960

Figures based on (1) 12-in. average depth of metal, and (2) molten metal occupies 46 per cent of available volume of the well.

Information supplied by H. Bornstein, chairman of the AFS Cupola Research Committee, for inclusion in the forthcoming book *The Cupola and Its Operation*.

How We Look to Others

Here's what Dutch productivity team thought of U. S. metal casting techniques and industrial operations. A candid report to their government.

"Oh wad some power the giftie gie us
To see oursels as others see us!"
—Robert Burns

Foundrymen who attempt to look at themselves and their operations objectively can do no better than to study the reports of the various productivity teams which have visited the United States during recent years. Latest report to be issued was prepared by the Netherlands team headed by Ir. A. Baron Krayenhoff, with Ir. A. de Jong as team secretary.

English Summary

A 180-page, 6½ x 9½-in. book with over 100 illustrations, the report contains nine pages in English summarizing the report and giving the team's conclusions and recommendations. Part of the summary reproduced below shows "oursels as others see us."

In everything, an American is production minded, not only in industry, the team observed. His active spirit and his everlasting confidence that everything done could be improved leaves the American open for any idea, technique, etc. As U. S. market conditions for castings, like other articles, open up far more possibilities, everyone is more willing to take risks when experimenting on new techniques or ideas. Free enterprise is the reigning device, but Americans disagree with cut-throat competition. Of course, there ought to be competition, but only to keep industrial life active and prices reasonable.

The motto on all government buildings "Obedience to law is freedom" is typical of the American philosophy of life; although they complain much about it, there is still fair discipline to apply the rules.

Every American is cost minded about every article. All cooperate to keep prices low and thus extend sales and gain larger profits. Leading people in industry consider cooperation with employees far more important than handling machines. A supervisor, assistant, or foreman should be critical of the employee as well as of the employer or his direct boss, without any fear for his position. People in this function have more independence than we are accustomed to. Much in productivity depends on the personality of a foreman, assistant, or supervisor. Keeping these persons at a high level of quality one can trust so much more to them.

There is more mutual contact between the factories as well as their employees. Their typical sense of reality was noted during conferences to discuss and to solve problems and even to examine them together. One of their axioms is: Undo all work as much as possible of human factors and standardize all the rest. You get a technical production to perfection and a minimum of risk on human errors.

Performance Stimulated

All the various possibilities of getting higher income and attaining a better position on account of good performance —such positions are open for everybody who gives such a performance—are stimulating productivity. Furthermore, high productivity is considered far more important than incidental cases of very high income. Other reasons for mechanization in the U. S. are: the high level of wages and the generally far bigger lines to be manufactured. With high wages it is easier to gain an investment with only relatively little saving of labor. In our country, with the lower level of wages and the far more costly machinery, we need too much saving in labor before investment is profitable. That is the reason why Americans say that we are wasteful of labor. And we consider them wasteful of material!

They consider a smooth moving on of orders as a primary condition to stick to promised dates of delivery. Good planning and perfect preparation of the order are considered a strict necessity. This part of the organization should not be supervised by the sales department as this department is not expected to have an eye for efficiency in the works.

Remarkable is American preference for quality of the material over the appearance of the castings. One can more easily sell a greater production in the U. S. as there are practically no limits nor frontiers to the market.

Utility Foundry Offices

Factory buildings are generally of simple size, while office buildings are mostly small, of sober outlook, and with simple furniture. Newly-built foundries have better looking offices with modern furniture although still strictly on a utility basis.

It is remarkable how punctually the results and methods from research institutes are put into practice. These institutes thus obtain reliable data in a short time, enabling them to develop their work successfully. Melting is done systematically and there is strict cupola control. Great value is attached to the fact that the work should always be done under the same circumstances. Our method of slag tapping (intermittent or syphon) is considered to be better than the American continuous slag tap at the back of the cupola. The way they let slag drop into water or a stream of water, seems to be very practical because the slag is granulated and easier to get rid of.

Molding sand problems in the U. S. are solved in quite a different way. Sand is obtainable as a selected base product to several specifications. The people who sell sand have complete industrial plants to make all desired qualities. They do their own research and can give every service to meet the specification of the clients.

Pattern-Foundry Teamwork

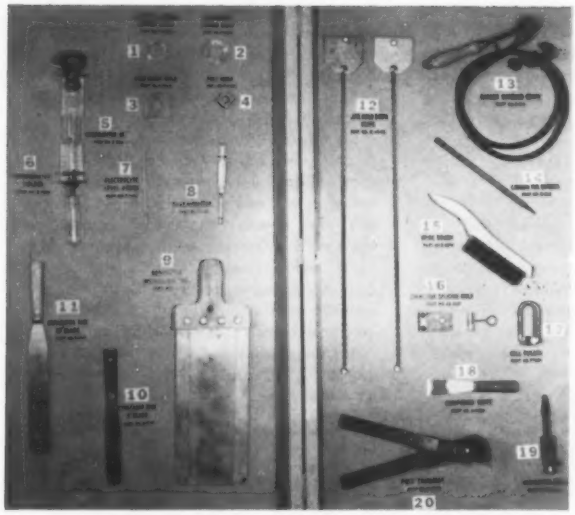
Patterns, core boxes, pattern plates, and matchplates for high production are finished to perfection. This is achieved as a result of close collaboration between the foundries and the specialized pattern shops which are independently operated. Good tools are half the job done. This certainly applies to patterns, core boxes, and matchplates. It is remarkable how much wood is used. The price and the almost unlimited stock of this material make it so attractive, that to our ideas they are wasteful with it. Enormous offside [follow] boards, bottom boards, and even skimmers are striking examples of it.

The American foundry worker has far more auxiliary machines at his disposal. Even little saving of expensive labor permits investing in machinery. Energy like gas, fuel, oil, and electricity is abundant and cheap, so who should care about using more. They prefer to use more cores to avoid complicated separations in the molds, thus avoiding the risk of rejected castings and saving molding time. A very practical method is taking chill tests of the molten iron from the spout. It is possible to correct the metal almost immediately or to use it in another mold.

Dust Control Practiced

The authorities more and more give prescriptions for the prevention of dust and ash pollution of the neighborhood. Much is done on hygiene problems which results in a more favorable climate for the employees which improves their performance. Relations with the trade unions were generally good. They seem to act with more fighting spirit but reasonable solutions are quickly settled on account of their sense of realism and business-like outlook on all matters of negotiation.

Great numbers of apprentices in the foundry field participate in prize contests [AFS Annual Apprentice Contest] and the winners are very proud of it. In this area still much could be done in our country to increase interest in the ability of foundry workers.



Complete set of battery maintenance and repair tools.

Personnel should know charging equipment, techniques.

Watch Those Batteries

K. A. VAUGHAN / *Manager, Field Engineering, Gould-National Batteries, Inc., Trenton, N. Y.*

■ *Foundries are finding increasing use for portable power sources in their operations. This article on battery use and maintenance is an expert approach to the subject.*

Batteries for cycle duty, as in electric fork-lift trucks, should be specified according to the capacity-recommendations of the manufacturer of the equipment to be served. There is often a tendency to substitute a smaller-capacity battery because superficial surveys indicate it will do the job. However, it must be remembered that the battery must supply power for peak-demand operations at any time during the shift and that extra uses invariably are found for battery-powered equipment.

Substituting a smaller battery almost always results in its being overworked, which overdischarges the battery and results in lower efficiency. Over a period of time, battery elements are inevitably damaged, with the result that maximum available life is not realized.

Availability of a sufficient number of spare batteries also is important. As a guide, 2.1 batteries per truck can be used as the minimum required for three-shift operation, provided available charging equipment can recharge each battery in eight hours.

Put one man in complete charge of battery operations, to centralize authority and responsibility. He should be well versed in battery technology and understand charging and maintenance procedures. The few safety rules applicable to storage batteries should be known and observed.

Some battery manufacturers conduct schools for customers' employees, maintain capable field engineering staffs that are available for consultation on battery problems and publish helpful manuals.

The simplest way to keep cycle-duty batteries at maximum efficiency is to establish a periodic maintenance and inspection schedule. The battery should be cleaned from once a day to once in several weeks, depending upon the atmospheric and other conditions under which it operates. Vent plugs should be in place and tight. Water must be added to replace that lost by evaporation once every one or two weeks when the battery is in full cycle service.

The specific gravity and voltage of each cell of the battery should be checked at least once every three months, preferably once a month, after an equalizing charge.

Number Identity for Records

Records of all charging and maintenance activities for cycle-duty batteries should be made and filed to form a case history of the battery. Identify each battery and truck by number. Such records show which batteries are being abused or are wearing out, and make it possible to take steps to correct abuses or replace units in time to prevent production stoppages. From these records troubles in operating equipment, charging equipment and charging schedules often can be diagnosed.

Also, the men handling battery maintenance are more conscientious if they are required to record such data as: date of charge; time; amperes; specific gravity at the beginning and end of charge; addition of water.

A battery must not be overdischarged if maximum life is to be attained. Although occasional overdischarge has no harmful effects, if continued it will harm the plates of the battery and shorten its life. In addition, when a battery nears complete discharge, its operating efficiency decreases.

A cycle-duty should not be overcharged because this results in gassing and overheating. Gassing causes loss of water from the electrolyte. The practice of consistent overcharging will permanently damage some of the elements of the battery.

Boost charges occasionally are necessary when trucks are doing extra-heavy

continued on page 218

Damaged cells should be removed from the battery case and repaired as soon as damage is discovered in routine maintenance check operations.

Watch Batteries

continued from page 217

work, or working extra hours. To prevent over-discharge of the battery, a brief charge is given during a lull in the work cycle (say, during the lunch period) to prevent unnecessary downtime of the truck.

An equalizing charge should be given to cycle-duty batteries at least once a month, but not more often than once a week. This is an additional charge of three or four hours at the finishing rate of the battery. The purpose is to make sure all cells are brought up to full charge.

Charging Stations

Considerable savings can be made in overall plant operation if charging stations are located strategically. In large plants, it can be advantageous to situate small charging stations in outlying departments.

If central charging is used, the charging station should be situated so that all trucks have approximately equal distances to travel for charging.

Central charging has the advantage that it is more easily supervised. If conditions call for spot charging, proper supervision is extremely important.

In some plants charged batteries are delivered to the equipment instead of having the equipment come to the charging room. The charged battery is placed in the fork-lift truck and the discharged battery is returned to the charging room.

It is particularly advantageous to schedule charging operations where a large fleet of trucks is employed, or where more than one shift is worked. By assigning each truck a certain time to report for charging, a backlog will not pile up at the charging room and truck downtime will be minimized.

Although charging equipment today is largely automatic, it must be correctly set for the size of battery charged. If a voltage relay timer governs the charging period, it should be inspected frequently to be sure it is in good operating order.

If the ampere-hour method of controlling the charge is used, charging men must be thoroughly familiar with ampere-hour-meter charts and utilize them correctly. Otherwise, the battery will be either overcharged or undercharged.

An occasional check-up of all charging equipment, ammeters, and voltmeters should be made. Although serious inaccuracies in this equipment will show up during charging, small inaccuracies can go unnoticed and over a period of time will lead to less efficient charging.

Batteries that are stored for a period of time should be given a freshening charge once every three months to keep them in a fully charged condition. If this is not done, the battery eventually will discharge itself by internal action and a lead sulphate film will form on the plates. If allowed to remain, this film will harden and impair the efficiency of the battery when it is put in use.

Although seldom required, battery repairs are sometimes necessary because of cracked containers, internal shorts, or rough handling. When inspections reveal a damaged cell, repairs should be made immediately, both to prevent further damage and to bring the battery back to maximum efficiency. If damaged cells are not replaced at once, the battery does not deliver full capacity and the other cells must stand harder duty to make up for those that are defective.

The battery room foreman should be familiar with repair techniques. A small supply of spare parts, such as jars, covers, and connectors, should be kept on hand, together with the proper instruments and tools.

Efficiency drops rapidly after a cycle-duty battery has been in service so long that it delivers less than 85 per cent of its rated capacity. When this point has been reached, it is advisable to replace the battery, to prevent work stoppages, extra charging and wasted power.

In addition to a small office for safekeeping of charging records, the battery room should have means of lifting batteries in and out of trucks. A set of standard and special tools and instruments for making battery adjustments and repairs should be available. Spare parts to get damaged cells back into service quickly will usually pay off. Water and compressed air for cleaning are useful. A source of distilled water, if local public water is not usable, is a must. Sulfuric acid storage battery use is essential.

Now, There's an Idea!

Practical ideas, developed and proved in foundries and pattern shops, are presented in this column. "Now, There's an Idea!" helps *American Foundryman* readers promote the exchange of ideas, the motivating force behind the AFS Contributions for publication are solicited. They may be of any length, preferably short, illustrated by photo or sketch.

■ Radiant heat, unlike convected and conducted heat, cannot be dealt with effectively through ventilation. Thus, when two American Brake Shoe Co. plants encountered radiant heat problems, Herbert J. Weber, chief industrial hygienist, solved them by *reflecting* the heat away from the people.

At the company's Electro Alloys plant, Elyria, Ohio, a row of ladle heaters outside the laboratory turned the wall into a radiator, making laboratory temperatures uncomfortably high. The wall and the laboratory cooled down to normal after a coat of aluminum paint was applied on the side of the wall next to the ladle heaters. High reflectivity of the aluminum turned the heat back instead of letting it pass through the wall.

Radiant heat from furnaces at the National Bearing plant, Chicago, prevented furnacemen from spending more than a few minutes near the melting units. Remedy was installation of a simple radiant heat screen constructed of angle iron and heavy gauge copper screen with mesh about ⅛ in. Black screen can also be used according to Mr. Weber. The screen (see photo) is raised and lowered by an air hoist. During melting, the screen is down, shielding operators from heat. The screen is raised for charging and unloading. (Item contributed by Walter Anderson, editor, *Brake Shoe News*.)

BUCKEYE *Continues to Develop and Improve its Products through Laboratory Research!*

NOW! NEW!

STICK FAST
Quick-Setting
CORE PASTE

Can serve you 2* ways

Photo Taken in Laboratory, Buckeye Products Co. Cincinnati

STICKFAST *Quick-Setting* Core Paste was developed to supply foundries with a product that is not only (1) refractory and heat resistant, (2) unaffected by molten metal and (3) will not boil, foam or blister during drying but also—(4) is very fast setting because of its low absorption rate (5) has excellent adhesive qualities and (6) has high strength—both green and dry. No other core paste offers half as much!

Save freight . . . STICKFAST is shipped in 300 lb. barrels . . . —You add the water at the foundry . . . Remains in powder form . . . yet easily mixed—no lumps when water is added . . . will not attract water when allowed to remain in molds for several days. Make *us* prove these claims—

Sample FREE! Write on your letterhead—today!

STICKFAST Core Paste has also proved to act as an excellent binder for cores, small and large, to increase hot strength and give harder core. Also prevents washing of core.

SEE BOOTH 318, AUDITORIUM HALL, A.F.S. CONVENTION, CLEVELAND, MAY 8-14

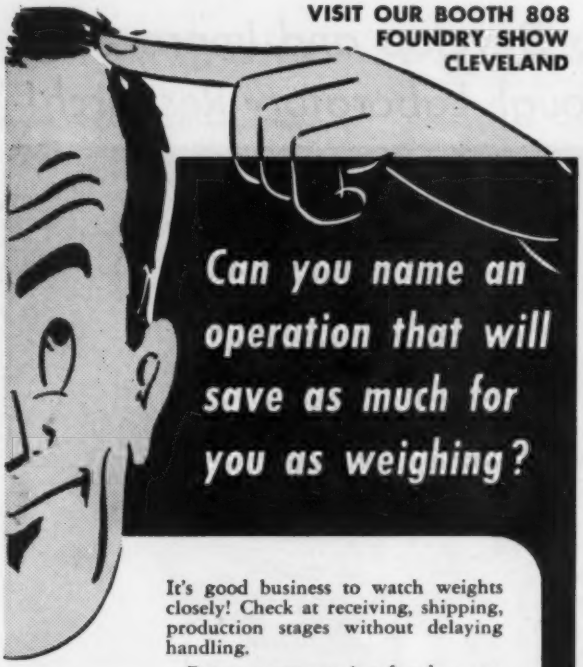
Manufacturers also of Avon Parting . . . Linseal and Buckeye Core Oils . . . Buckeye High Temperature Furnace Cement . . . Slinger-Slick . . . and Parlex (Liquid Partings) . . . Linco Core Compound . . . Buckeye Patented Flask Guides, and Specialty Foundry Products.

BP

THE BUCKEYE PRODUCTS CO.

7020 VINE ST. • Cable Address "Buckprod" • CINCINNATI 16, OHIO

VISIT OUR BOOTH 808
FOUNDRY SHOW
CLEVELAND



Can you name an operation that will save as much for you as weighing?

It's good business to watch weights closely! Check at receiving, shipping, production stages without delaying handling.

Put a stop to paying for dunnage, inaccuracies, other's miscalculations that rob you of your profit. Weigh loads as you lift them to move them by crane or hoist. Speed inventories, eliminate labor and equipment tie-ups at the weighing station.

Thousands of HYDROSCALES are at work in large and small plants all over the country.

The cost of weighing has been reduced to a minimum by—

HYDROSCALE

HYDRAULIC CRANE SCALE

36 models
500-200,000 lbs.

12", 24", 30" dials

Tilt face models for high level reading

Combined reading kilogram-pound dials

Batching models indicate pour-off

Write for our catalog or demonstration in your plant.

HYDROWAY SCALES, INC.
20624 WEST 8 MILE ROAD · P. O. Box 4754 · DETROIT 19, MICH.

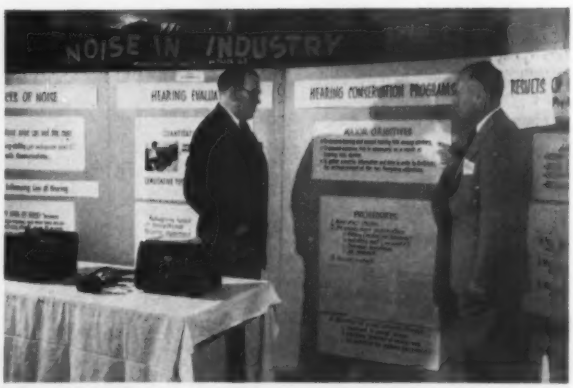
Foundrymen attending safety training course

Hold Foundry Safety Course at Butler

A TRAINING course in the fundamentals of foundry safety was held at Butler University, Indianapolis, on March 23-24. Sponsored by the educational committee of the Central Indiana AFS Chapter, the session was attended by 24 foundrymen representing 12 foundries in the area.

The course was planned to include a general review of those phases of industrial safety most applicable to the foundry. Among the topics included were: Basics of Foundry Safety, Foremen's Safety Conference Committee, Building Safety into the Plant, Machine Guarding, Foundry Safety Inspection, Accident Records and Analysis, Materials Handling, Foundry Health Problems and Control, Good Housekeeping, and a demonstration of safe lifting technique.

Central Indiana Chapter members who served on the organizing committee were: A. A. Evans, International Harvester Co., Indianapolis; Dallas Lunsford, Perfect Circle Corp., Hagerstown, Ind.; and J. A. Barrett, National Malleable & Steel Castings Co., Indianapolis.



Walter F. Scholtz (right) explains hearing conservation program to Mark Highberg, foundry superintendent, Nash-Kelvinator Corp., Kenosha, Wis., at recent Wisconsin Regional Conference.

F. E. F. Meeting

continued from page 204

booklet, he said, and reported on a study to measure the degree of malleablization by determining the coercive force of malleable specimens.

All teachers in mining and metallurgy at the University of Wisconsin are associate professors and professors, E. R. Shorey, head of that department reported. No student instructors are used, he said, although 10 student assistants are working on research problems. He directed attention to his school's awareness of industry and its cooperation and stated that Wisconsin was conducting the AFS malleable research project and that Prof. P. C. Rosenthal and Prof. R. W. Heine had recently completed the text for the AFS college text on foundry technology. Prof. Heine outlined teaching practices at Wisconsin.

Success of a 1953 summer short course combining lectures, problems, and laboratory work was reported by Prof. R. A. Flinn, University of Michigan. Industry is slow to adopt the quantitative approach to foundry problems he said. The regular undergraduate courses avoided the craft aspects of education, he declared, stating that this didn't discourage the students since Michigan had the largest (126 members) student chapter of AFS, the second largest student organization on the campus.

Prof. C. C. Sigerfoos, Michigan State College, outlined a foundry option with special advanced foundry courses available to mechanical engineering seniors, and enumerated the projects FEF scholarships students were working on.

Prof. G. M. Cover, Case Institute of Technology, discussed participation in a television program featuring the foundry industry, a topic also covered by Flinn and Sigerfoos.

At the University of Cincinnati, Prof. D. L. Crews said, guest lecturers from industry are used to cover specialized foundry operations.

The two-day meeting was summarized by Prof. Howard F. Taylor, Massachusetts Institute of Technology, who made the following points among a number in his resume:

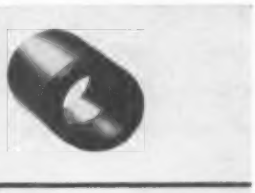
1. Focus FEF attention on industrial aspects of implementing the Foundation's original program. Increase present industry support, if possible; in any case don't reduce it.
2. It is an industry obligation to absorb trained men, and industry should also consider more extensive use of men with advanced degrees.
3. Industry should take more interest in teachers and their curricula.
4. Industry should take advantage of the student's ability to think but should not expect him to have all the answers.
5. Recruiters should make the student feel the company has a place for him, not that a place will be created.
6. Students should not compete with foremen.

these MARTIN products for core box protection

PETERSON VIBROLATOR quietly moves materials from bins and hoppers. Always instant starting. No maintenance, no lubrication. "Vibra-Tak" pocket-size vibration meter available. Check dead spots on vibrated match plates, bins, hoppers.

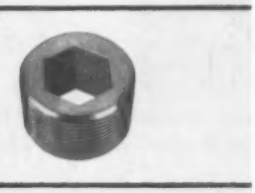
"SAND ARRESTER TUBE"

Save cores and step up production. Guaranteed for 100,000 blows.



"HOLINER" BUSHINGS

Stop abrasion between blow plate and core box. Protect blow holes.

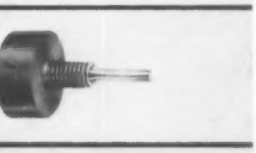


"PROTEXABOX" PINS

Cannot mar the box face because of protective rubber tip. Guaranteed to stay on.

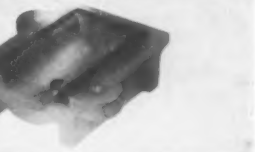
"PULLINSERT" BLOW BUTTONS

Positively stop sand blasting under blow holes. Available in nine popular sizes.



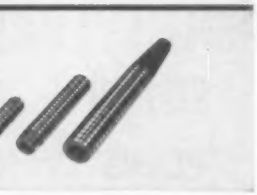
"STRIPINSERT"

Protects parting line — easily installed in old or new boxes. Cutters for groove available at moderate cost.



NON-BINDING FLASK PINS

No production stoppages due to bending or binding of flask pins. Flexes and absorbs abuse, assures easy, perfect match.



See your distributor or write for literature to—

MARTIN ENGINEERING COMPANY

KEWANEE 3, ILLINOIS

Complete Stocks... Reliable Service

That's the combination which has built "Pennsylvania" into the largest and most active warehouse supplier of

FOUNDRY SUPPLIES AND EQUIPMENT in the East.

Just name your need and we will meet it . . . Abrasives, Binders, Core Compounds, Core Oils, Core Wash, Equipment, Facings, Mold Wash, Refractories, Sand, Tools . . . and so on through the entire list of Foundry requirements. *Always ready for immediate delivery,* with special service in emergencies.

Fast Service **IF YOU ARE LOCATED IN THIS AREA . . .**

Sales Representatives and Technicians:

F. B. ELIASON—New Jersey and Eastern New York
R. J. BRANDT—New England
L. R. TIERNEY—Eastern Pennsylvania
B. B. McCLARY—Baltimore Area
EARL SWENSEN—Western Pennsylvania, Virginia, West Virginia, North Carolina

Philadelphia Office:
A. H. CIAGLIA J. E. DAVIS, JR.
PAUL BAKER JOHN J. PODESVA

New England Division:
Malkin Warehouse
54 Chapel St.,
New Haven, Conn.
Telephone:
LOcust 2-5115

PENNSYLVANIA FOUNDRY SUPPLY & SAND CO. SUPPLIES EQUIPMENT "Everything!"

Send for Illustrated Booklet Entitled "Everything for the Foundry Industry."

PENNSYLVANIA FOUNDRY SUPPLY & SAND CO.

PENNSYLVANIA CHAPLET CO.

ASHLAND and EAST LEWIS STREETS
PHILADELPHIA 24, PA. **Phone: JE 5-1012**

G.I.F.S. Names Technical Director

GRAY Iron Founders' Society, Cleveland, has announced the appointment of Charles F. Walton as technical director. Mr. Walton has most recently been assistant professor of metallurgy, Case Institute of Technology, a position he has held since 1948.

He graduated with a degree of metallurgical engineer from the University of Minnesota in 1939, worked with Inland Steel Co. for two years after. From 1941-1944 Walton was with the Association of Manufacturers of Chilled Car Wheels, Chicago, doing metallurgical research. He was with Meehanite Corp. from 1945 until his affiliation at Case Institute. At G.I.F.S., Walton will replace the late Charles O. Burgess.

Cast Metals Courses Scheduled at University of Michigan

UNIVERSITY of Michigan, Ann Arbor, has scheduled two courses for design engineers, foundrymen, and metallurgists covering cast metals in engineering design.

Course 1, *Properties of Cast Metals,* is planned for August 9-14, and will cover all the major cast metals and the correlation of properties with microstructure, melting practice, and heat treatment. Metals included are aluminum, magnesium, titanium, copper, cast and ductile iron, malleable iron, and steels. Lectures, discussions, technique demonstrations and laboratory practice sessions are planned in each field.

Course 2, *Application of Cast Metals,* will review the various phases of industry in which foundry techniques are used, including aircraft, automotive, railroad, ordnance, power, chemical, and miscellaneous.

The courses will be accepted for academic credit. Fee for Course 1 is $90, Course 2, $60. Registrations must be completed by June 5. Housing will be available at the Michigan Union at $4 per day and up. For full information, address the College of Engineering, University of Michigan, Ann Arbor.

Bohn Receives Foundation Award

BOHN Aluminum & Brass Corp. received the top award in the advertising category of Freedoms Foundation for its 1953 campaign. Bohn president S. D. Den Uyl (center in photo) is shown receiving gold medal at Valley Forge, Pa. from Dr. Milton Eisenhower, president, Pennsylvania State University. At right is Dr. Kenneth D. Wells, president, Freedoms Foundation. The Bohn ad campaign highlighted a question-and-answer series involving some of America's most distinguished men of industry and science.

East Coast

continued from page 213

(Va.) Foundry Co. He was introduced by Chairman B. N. Ames., Doran Manganese Bronze Co., Brooklyn.

Curry gave the foundrymen a cross-section of his own plant's experience with shell molding. Any shop, he said, must determine whether it has sufficient trained personnel with engineering knowledge to handle the process, must decide if the potential market justifies the cost of installation, and whether each plant should do pilot work relative to its size. He gave an emphatic yes to the final question, then detailed Lynchburg's experiences with shell casting dimensions. Each casting must be studied separately with regard to its position in the mold and its particular characteristics to intelligently predict the tolerance of dimensions to be obtained in production. He outlined the rules used in his plant for shell mold castings, depending on direction of critical dimensions and other factors.

Straight Surfaces Difficult

Out-of-roundness has been encountered when critical dimensions are all in one side of the mold, and there has been difficulty in producing a straight flat surface with the shell process. The latter fault can be alleviated with use of proper synthetic resins for greater rigidity and application of adequate back-up medium.

In general, Curry said, the greater the size of the casting, the greater the tolerance needed for specified dimensions, although this rule is not universal.

Improved surface finish, characteristic of shell molding, aids in obtaining dimensional tolerances, and provides customer appeal. However, shell molding is not an automatic means of producing a good surface finish, but requires careful study. Savings in machining operations can also be considerable when shell molding is used, Curry declared.

Cleaning of shell molded castings will be more complex since the process removes some of the operations of the machine shop to the foundry. Ordinary knock-out handling and blasting are not sufficient since the high finish requires careful processing.

A three-man panel followed Mr. Curry and presented problems associated with shell molding in their phase of the foundry industry. Speaking for patternmakers, E. H. Rubovitz, Newark (N.J.) Pattern Works, said that shell pattern costs are higher because of the need for close tolerances and surface finish quality. Fully-machined patterns are necessary, he stated. Cast iron patterns have been found to do a good job in high production shell runs.

L. R. Spann, Eastern Malleable Iron Co., spoke for the malleable group. Shell molding, he indicated, requires a combination of engineering and imagination.

continued on page 226

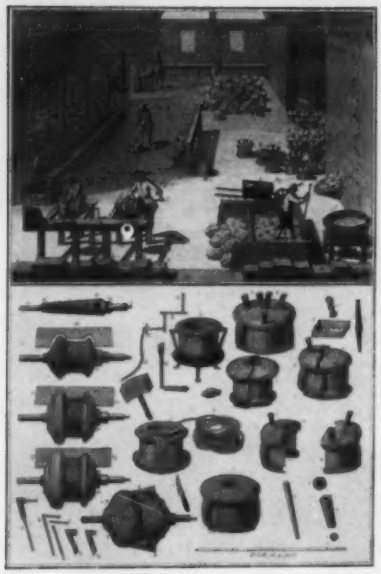
HAUSFELD
FURNACES

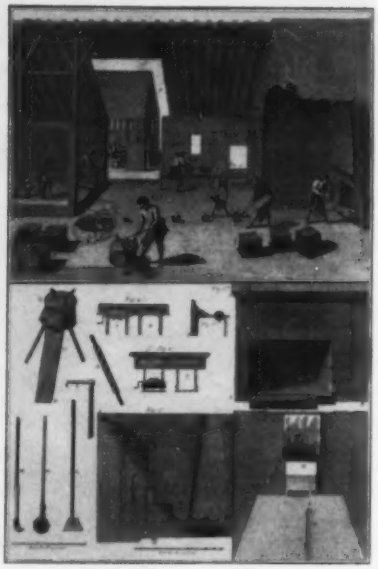
FOR "ALL-OUT" PRODUCTION
IN NON-FERROUS FOUNDRIES

Provide the
Utmost in Speed
Production
and Safety

FURNACES FOR
BRASS • ALUMINUM • MAGNESIUM
AND ALL OTHER
NON-FERROUS ALLOYS

The Campbell-Hausfeld Co.
900-920 MOORE ST. HARRISON, OHIO





AFS Receives Old Foundry Illustrations

Two rare old French illustrations from an 18th century foundry publication have been given to the American Foundrymen's Society by a prominent foundryman who wishes to remain anonymous. Expected to be hung in the library of the foundry technical center the Society will occupy after the middle of the year, the old engravings were made in 1718 and are remarkable for their color and detail. They depict the molding, pouring, and cleaning of three-legged cooking pots. Legs and handles are formed by cores fastened to the outer shell of the mold. Inner core, held in position by means of lead balls acting as chaplets, is formed on a mandrel and is bulit up with straw rope. Loam is shown being prepared by a barefoot foundryman kneading the mixture in a box with his feet. The engraving will be added to a number of other library acquisitions received through the courtesy of foundrymen from the Americas and abroad.

Cope and Drag Club Elects New Officers

Gating and pH were discussed at the February 10 meeting of the Cope & Drag Club of Milwaukee. Jos. E. Schumacher, Hill & Griffin Co., Cincinnati, presented a graph and calculations for developing a gating system for gray iron based on a flow rate of 100 lb of iron in 6.3 sec through 1 sq in. of ingate area.

Bradley H. Booth, Carpenter Bros., Milwaukee, reviewed research on pH he had reported in AFS TRANSACTIONS. He said pH is a means of controlling properties after having established the desired range of property values using appropriate binders and additives.

Booth Elected President

Booth was named to succeed Eugene W. Smith, Chicago, as president of the club. Robert L. Doelman, Miller & Co., Chicago was elected vice-president. Re-elected secretary-treasurer was Herbert F. Scobie, technical editor, AMERICAN FOUNDRYMAN.

FOUNDRYMEN!

Eliminate Sand Sticking in Wood or Metal Patterns and Core Boxes;

Increase Productivity; Lessen Costs;

Improve the Finished Quality of Your Castings

by using

1. OFFERS MORE RESISTANCE TO ABRASION, MOISTURE, CORE OILS, KEROSENE, GASOLINE, SYNTHETIC BINDERS, ETC.
2. ABSOLUTELY WILL NOT STICK IN THE FOUNDRY—GIVES THE EFFECT OF A PARTING.
3. HAS EXCELLENT WORKING QUALITIES — GOOD BRUSHABILITY, ADHERENCE, AND PENETRATION.
4. HAS PLEASING ODOR.

5. DRIES OVER WAX.
6. HAS UNUSUALLY GOOD APPEARANCE . . . VERY GOOD GLOSS . . . STRONG BRILLIANT COLORS.
7. ONE COAT COVERS. NEVER MORE THAN TWO COATS REQUIRED.
8. REQUIRES NO SANDING BETWEEN COATS. KINCOTE IS SELF-LEVELING.

the Quality Pattern Coating!

Master KINCOTE is packaged in one gallon containers. It is available from stock in the following colors: clear orange (shellac-colored), black, vermilion, yellow, aluminum, white, green and gray.

A Product of THE KINDT-COLLINS COMPANY, 12653 Elmwood Ave., Cleveland 11, Ohio

Chapter Meetings

May

3. . Western Michigan

Cottage Inn, Muskegon, Mich. Joseph S. Schumacher, Hill & Griffith Co., Cincinnati, "Fool Proof Sand."

3. . Central Illinois

American Legion Hall, Peoria, Ill. W. H. Hisey, Goodyear Tire & Rubber Co., Akron, Ohio, "The Road Back."

3. . Central Indiana

Athenaeum, Indianapolis, Ind. Howard Wilder, Vanadium Corp. of America, "Recent Developments in Cupola Control."

3. . Chicago

Chicago Bar Association, Chicago. Annual Business Meeting.

4. . Rochester

Seneca Hotel, Rochester, N. Y. Election of Officers.

6. . Saginaw Valley

Fischer's Hotel, Frankenmuth, Mich. Round Table Meeting. Ferrous, "High Pressure Molding." Light Metals, C. L. Wheeler, Aircraft Engine Div., Ford Motor Co., "Comparison of Al and Mg Foundry Characteristics."

14. . Texas

Galveston, Texas

18. . Twin City

Panel Discussion.

19. . Central Michigan

Hart Hotel, Battle Creek, Mich. Ben Taylor, B. F. Goodrich Co., "Today's Challenge in Human Relations."

19. . Oregon

Annual Business Meeting

20. . Western New York

Hotel Sheraton, Buffalo, N. Y., Smorgasbord.

20. . Northeastern Ohio

Tudor Arms Hotel, Cleveland. Past Chairmen's and Old Timers' Night.

20. . Detroit

Plant Visitation.

21 . . Philadelphia

Engineers' Club, Philadelphia. Harry Day, Auto Specialties Co., St. Joseph, Mich., "C" Process and "D" Process."

21. . Wisconsin

Old Timers & Apprentices.

24. . Northwestern Pennsylvania

Moose Club, Erie, Pa. Annual Meeting —Election of Officers. Harry Gravlin, Ford Motor Co., Detroit, "Men, Metal, Sand."

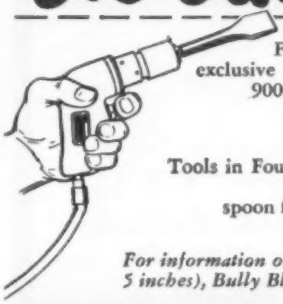
28. . Ontario

Royal York Hotel, Toronto, Can. Ladies' Night.

Remove Casting Fins Faster

with this 6 inch, 50 ounce

BIG BULLY AIR HAMMER



Fits securely into hand. By varying pressure on the exclusive metering trigger operator can produce from 0 to 9000 blows per minute. Much faster and more accurate than hand hammer and tools. Air Consumption . . . 6.5 C.F.M. at 150 p.s.i. max. working pressure.

Tools in Foundry Kit include two flat chisels (⅜" and 1") for removing fans from castings, gouge, peening and spoon face chisel. List of other tools available upon request. Special tools produced to your specifications.

For information on the Big Bully, Bantam Bully (20 ounces, 5 inches), Bully Blow Gun and Bully FulFlo Air Filter write . . .

SUPERIOR Pneumatic and Manufacturing, Inc.
4758 WARNER ROAD • CLEVELAND 25, OHIO

MR. PRODUCTION FOREMAN:
YOU, TOO, WILL BE ASKED THIS QUESTION SOONER OR LATER, BETTER CHECK UP BEFORE IT'S TOO LATE!
WE'LL SEND YOU COMPLETE INFORMATION AND PRICES VIA RETURN AIR MAIL!
Phone, wire or write us RIGHT NOW!

Severance TOOL INDUSTRIES INC.
736 IOWA AVE., SAGINAW, MICHIGAN

A SEVERANCE CARBIDE HAND FILE HAS:

- Replaced 150 ordinary Files before being resharpened.
- Been resharpened 10 times.
- Worked the hardest plastic known at a substantial savings.
- Been used on hardened dies.

Phone:
SAGINAW
3-8421

Foundrymen Depend On:

HYBOND CORE OILS

FASTRBAKE CORE OILS

for • Lower Production Costs
• Core Uniformity
• Reduction in Scrap
• Cleaner Working Core Sand
• Faster Production

(SEE CONVENTION DISPLAY — BOOTH 813)

Investigate the Advantages of These High Production Core Oils—*Write or Phone for Complete Information.*

Manufactured and Sold Only by **MAGIE BROTHERS Inc.**

1640 CARROLL AV. CHICAGO 12 • HAYMARKET 1-0404

for Free-flowing Bins, Hoppers and Chutes

install *SYNTRON* **ELECTRIC VIBRATORS**

Assure a positive flow of fine powders or hard-to-handle lumps on bulk handling jobs where speed and economy are important. 3600 electromagnetic vibrations per minute eliminate arching, plugging and clogging. Compact—easy to install—low operating cost.

Write today for complete catalogue data—Free

SYNTRON COMPANY
545 Lexington Avenue Homer City, Penna.

Chapter Meetings

continued from page 225

Chesapeake

Engineers Club, Baltimore, Md. Management Night. Joint Meeting with the Conestoga Foundrymen's Association.

28 . . Birmingham

Birmingham. Installation of Officers.

June

5 . . Saginaw Valley

Annual Outing

12 . . Central Illinois

American Legion Hall, Peoria, Ill. Annual Stag.

19 . . Western New York

Depew Grove, Depew, N. Y. Picnic.

Chesapeake

The Crab Feast and Boat Ride.

Detroit

Annual Stag Outing.

Northeastern Ohio

Annual Outing.

July

30 . . Wisconsin

Golf Party.

East Coast

continued from page 223

Closer, more knowledgeable supervision is mandatory in a precision process of this type. He raised the question of scabbing, to which Curry replied that it was no problem at Lynchburg. Curry also reemphasized that a tumbling action is likely to scar a close finish, that ordinary air blasts should clean most shell castings.

Plastics Speaker

James Summers, Chemical Div., General Electric Co., was spokesman for the plastics industry. He said that many factors influence the amount of resin used and that they varied widely. Summers listed the tests used by resin manufacturers to determine their characteristics. Finally, he predicted that resin coating of sands would be done in individual foundries, not by the resin or sand producers.

Following the conclusion of discussions by Mr. Curry, panel members, and the audience, the Conference was declared officially adjourned at noon. Foundrymen attending agreed that the meeting had been successful.

Abstracts

Abstracts below have been prepared by Research Information Service of The John Crerar Library, 86 East Randolph Street, Chicago 1, Ill. For photoduplication of any of the complete articles briefed below, write to Photoduplication Service at the above address, identifying articles fully, and enclosing check for prepayment. Each article of ten pages or fraction thereof is $1.40, including postage. Articles over ten pages are an additional $1.40 for each ten pages. A substantial saving is offered by purchase of coupons in advance. For a brochure describing Crerar's library research service, write to Research Information Service.

A416 . . "New Techniques Shorten Investment Casting Cycle," W. G. Patton, *Iron Age*, vol. 173, no. 4, January 28, 1954, pp. 115-117.

New precoating material that resists heat shock combines with plastic patterns to shorten time cycle in investment casting.

A417 . . "Cut Tool Costs, Simplify Design with Precision Casting," Stanley Snorek, *Iron Age*, vol. 173, no. 6, February 11, 1954, pp. 136-139.

How to reduce tool design problems and costs by using castings made by the several precision methods available.

A418 . . "Vitreous Enamelling in Sweden, Denmark, and Finland," J. H. Gray, *Foundry Trade Journal*, vol. 95, no. 1944, December 3, 1953, pp. 679-686, vol. 95, no. 1945, December 10, 1953, pp. 725-728.

Detailed report on enamelling practices based on visits to plants in Sweden, Denmark, and Finland.

A419 . . "Shell Molding of Cylinder Castings," A. Emmerson, *Foundry Trade Journal*, vol. 95, no. 1944, December 3, 1953, pp. 687-696.

Full description of shell molding process as applied to production of automotive castings up to 200 lb in weight.

A420 . . "Experiences in Degassing Aluminum Alloys," D. P. Sparham and E. A. Moult, *Foundry Trade Journal*, vol. 95, no. 1947, December 24, 1953, pp. 777-781.

Methods of producing gas-free aluminum alloy castings practiced in British naval shipyards.

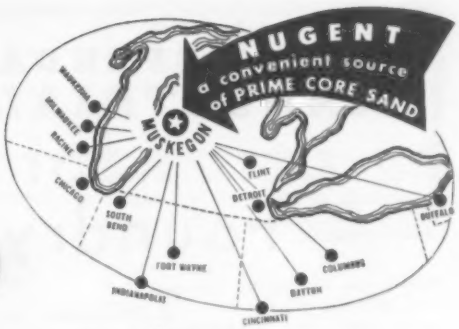
A421 . . "Partial Mechanization Gives High Output in Small Area," *American Foundryman*, vol. 25, no. 1, January 1954, pp. 36-39.

Mechanization of sand handling and shake-out combine with simple track and wheeled bottom boards to speed stack mold production of gray iron castings.

A422 . . "Blow-in Core Driers Used for Close Tolerances," *American Foundryman*, vol. 25, no. 1, January 1954, pp. 40-43.

continued on page 228

FIVE GRADES of CORE SAND



tested before you use them!

Exclusive with Nugent — 5 grades of dune sand processed from the best Muskegon Dune Sand — dried — graded to a constant AFS grain analysis of 39, 43, 48, 52 and 55 maintained through daily testing. Gives more uniform cores — consistently uniform molds — complete shipping and bulk storage facilities — prompt shipments of sand by rail or truck when you need it — based on over 40 years of "know how" supplying prime core sand.

Call or write your Nugent Representative today

INDIANA PRODUCTS CO. Kokomo, Indiana
WARNER R. THOMPSON CO. Detroit 8, Michigan
KEENER SAND & CLAY CO. Columbus 15, Ohio
CARPENTER BROTHERS, INC. Milwaukee 3, Wisconsin
GREAT LAKES FOUNDRY SAND CO. Detroit 26, Michigan

1912 CANNON core sand 1954

THE NUGENT SAND COMPANY, INC. MUSKEGON, MICHIGAN

Fast, Accurate, Economical METAL ANALYSES Per Direct Reading Quantometer

Provides SPECTROCHEMICAL ANALYSIS that evaluates ALL elements with TWICE THE ACCURACY AND SPEED of the standard Spectrographic determination . . . TWENTY TIMES THE SPEED of routine chemical processes.

24 HOUR SERVICE, by air, wherever your location. All routine samples are analyzed the same day they are received . . . results reported by phone, wire or airmail . . . at extremely moderate cost. Send today for PRICE LIST, PROCEDURES and OTHER SERVICES available.

PDQ Service with the PCQ* (*Production Control Quantometer)

FREE FOLDER GIVES YOU THE FACTS AND PRICES FOR THIS Speedy Economical Service

CHICAGO SPECTRO SERVICE LABORATORY, INC.
Chemical and Spectrographic Analysts
2454 West 38th Street Chicago 32, Illinois

NAME.....
FIRM.....
ADDRESS.....
CITY..... ZONE..... STATE.....

DEPENDABLE INDUSTRIAL SANDS for Foundrymen

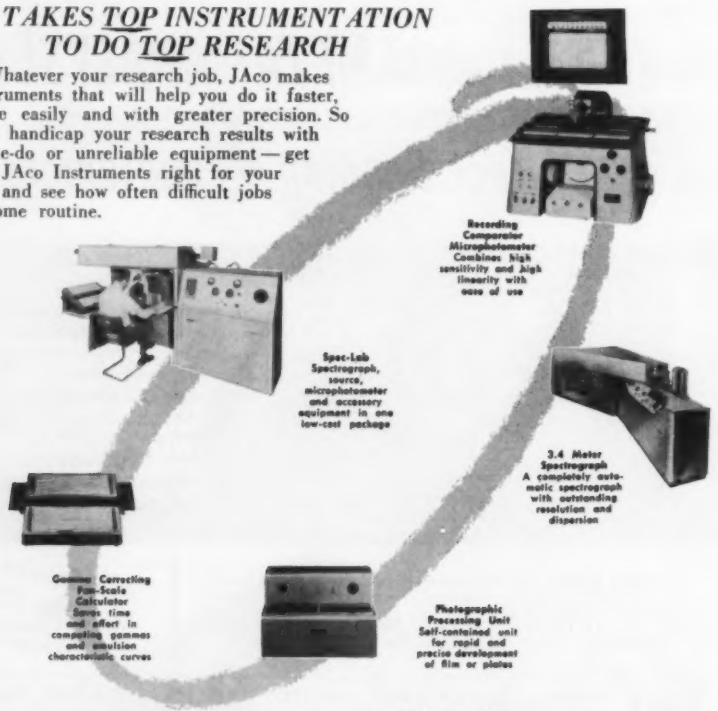
THROUGH our 25 years of progress and experience industry has come to depend on the service of Industrial Silica. Technological advancement and efficient methods have proved our products better . . . in preparation, uniformity and quality. In addition to molding and core sands, we produce closely graded sands and gravels for many uses in the ferrous and non-ferrous industry.

PORTAGE • GEAUGA
VENANGO • COXEY

INDUSTRIAL SILICA CORPORATION
1929 --- 1954
315 Stambaugh Building
YOUNGSTOWN, OHIO
Visit Us at Booth 1707

IT TAKES TOP INSTRUMENTATION TO DO TOP RESEARCH

Whatever your research job, JAco makes instruments that will help you do it faster, more easily and with greater precision. So why handicap your research results with make-do or unreliable equipment — get the JAco Instruments right for your job and see how often difficult jobs become routine.


Recording Comparator Microphotometer Combines high sensitivity and high linearity with ease of use
Spec-Lab Spectrograph, source, microphotometer and accessory equipment in one low-cost package
3.4 Meter Spectrograph A completely automatic spectrograph with outstanding resolution and dispersion
Gamma Correcting Fan-Scale Calculator Saves time and effort in computing gammas and emulsion characteristic curves
Photographic Processing Unit Self-contained unit for rapid and precise development of film or plates

Write for catalogs

JAco JARRELL-ASH COMPANY
26 FARWELL STREET, NEWTONVILLE, MASS.

Spectrographs—Source Units—Microphotometers—Spectrographic Laboratory Accessories X-Ray Equipment—Geophysical Instruments Refractometers—Polarimeters—Microscopes

SALES OFFICES

DETROIT 13680 Capitol Ave. | EL CERRITO, CAL. 1344 Devonshire Drive | CHATTANOOGA 1431 Broad Street | QUEENS VILL., N. Y. 80-36 230th Street

Abstracts

continued from page 227

Production of accurate core driers by means of composite mold with permanent metal drag and green sand cope.

A423 . . "Cooperative Safety Program Produces Outstanding Record," ***American Foundryman*****, vol. 25, no. 1, January 1954, pp. 44-48.**

How foundry reduced accident frequency by more than 46 per cent and lowered the severity rate by 98 per cent over a six-year period.

A424 . . "Quality Control in the Foundry," James M. Barabee, ***American Foundryman*****, vol. 25, no. 1, January 1954, pp. 50-54.**

Details of simple quality control procedures effectively applied in several gray iron shops.

A425 . . "Colorimetric Determination of Acid-Soluble Aluminum in Steel," M. C. Steele, ***American Foundryman*****, vol. 25, no. 1, January 1954, pp. 56-57.**

Metallic aluminum and aluminum nitride are determined with an absorptiometer after mercury cathode separation of iron.

A426 . . "Machinability and Microstructure," Hans J. Heine, ***American Foundryman*****, vol. 25, no. 1, January 1954, pp. 58-61.**

Why gray iron castings machine the way they do.

A427 . . "The Engineer in Profile—a Character Analysis," J. Elliott Janney, ***American Foundryman*****, vol. 25, no. 1, January 1954, pp. 62-63.**

Industrial psychologist gives qualities of engineers as guide to their use in foundries.

A428 . . "Master Patternmaking Aids Production," H. Wilson, ***Foundry Trade Journal*****, vol. 96, no. 1949, January 7, 1954, pp. 5-11, vol. 96, no. 1950, pp. 47-52.**

Solutions to patternmaking problems encountered in the author's shop.

A429 . . "Control in an Investment Foundry," D. F. B. Tedds, ***Foundry Trade Journal*****, vol. 96, no. 1950, January 14, 1954, pp. 37-42, vol. 96, no. 1951, January 21, 1954, pp. 77-82.**

Production methods, process control, and wax tests used in 40,000 sq ft-investment foundry producing aircraft castings.

A430 . . "Cored Holes in Castings Tapped Faster, Cheaper," W. G. Patton, ***Iron Age*****, vol. 173, no. 3, January 21, 1954.**

Automatic, multiple tapping applied to production threading of cored holes in die castings.

A431 . . "Preview Your Die Castings," Kenneth A. Cool, ***Precision Metal Mold-***

continued on page 229

Abstracts

continued from page 228

***ing*, vol. 12, no. 2, February 1954, pp. 49-50, 88, 89.**

Plaster mold castings, comparable in every respect to the die castings eventually to be produced, are used by the author to preview parts prior to making high investment in dies.

A432.. "One Company's Experience with Shell Mold Castings," T. W. Curry, *Materials & Methods*, vol. 39, no. 2, February 1954, pp. 102-104.

Dimensional tolerances, finish, machining reduction, and cleaning operations reported by company which produces both green sand and shell mold castings.

A433.. "Steel Castings Production," *Iron & Steel*, vol. 27, no. 2, February 1954, pp. 43-47, and vol. 27, no. 3, March 1954, pp. 89-91.

Describes shop practice at Darwins, Ltd., for mechanized jobbing, and stack molding. Floor plan and numerous illustrations including mold construction details for large drums and impellors.

A434.. "Control and Observation of Dust at Portable Abrasive Wheels and Pneumatic Chisels," A. T. Holman, E. B. James, and W. B. Lawrie. *Chartered Mechanical Engineer*, vol. 1, no. 3, March 1954, pp. 119-122.

Photographs and discussion of dust created under various conditions of dust removal. Novel method of dust control features hollow chisel for evacuating dust created at chisel point. Article is abstract of paper to be presented April 9, 1954, in London.

A435.. "Coremaker's Nightmare—Making Air Brake Castings," *Canadian Metals*, vol. 17, no. 3, March 1954, pp. 28, 30, 32.

Production and assembly of complex cores for production of air brake castings at Canadian Westinghouse, Hamilton, Ont.

A436.. "Evaluation of Casting Processes," P. W. Beamer and S. C. Tingquist. *Product Engineering*, vol. 25, no. 3, March 1954, pp. 139-144.

Emphasizing the versatility of the casting process, the authors discuss six basic casting methods (sand, shell, plaster, investment, permanent mold, die casting) and the factors to consider in selecting the best for a particular job. Includes tabular comparison of casting processes.

A437.. "Carbon Resistance Furnace for Determination of Gases in Steel by the Vacuum Fusion Method," R. M. Cook and G. E. Speight. *Journal of the Iron & Steel Institute*, vol. 176, no. 3, March 1954, pp. 252-256.

Vacuum fusion apparatus is described and illustrated with line drawing. Analytical procedure calculations, and results are given.

A438.. "Determination of Aluminum in Iron and Steel," Methods of Analysis Committee, British Iron & Steel Research Association. *Journal of the Iron & Steel Institute*, vol. 176, no. 3, March 1954, pp. 263-267.

Methods use mercury cathode removal of iron and related elements followed by sodium benzoate or 8-hydroxyquinoline treatment. Results on synthetic solutions and on steels are reported.

A439.. "Formation of Ferrite in Hypoeutectoid Plan Carbon Steels," C. Margaretha Hickley and J. H. Woodhead. *Journal of the Iron & Steel Institute*, vol. 176, no. 2, February 1954, pp. 129-139.

Reports study of rate of formation of ferrite during isothermal decomposition of austenite. Reaction is followed by quantitative microscopy, and the effects of nucleation and growth have been estimated.

A440.. "Kinetics of First-Stage Graphitization in Iron-Carbon-Silicon Alloys," J. Burke and W. S. Owen. *Journal of the Iron & Steel Institute*, vol. 176, no. 2, pp. 147-155.

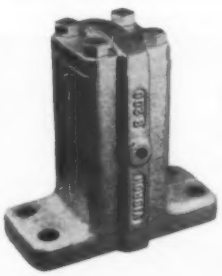
Reaction-rate curves for some high-purity alloys isothermally graphitized in the austenitic range have been deter-

continued on page 230

For The Cost Conscious FOUNDRYMAN

VIBRON

Announces NEW Low-Cost Pneumatic VIBRATORS And Lightweight REFRACTORY GUN



VIBRON Heavy Duty Quiet or Hammer Action Vibrators — reduce processing time by vibrating bins, chutes, hoppers and screens to prevent arching and sticking of materials. Also, they effectively eliminate air pockets in forms and increase the efficiency of sand handling operations. The exclusive non-impacting design of the quiet action vibrators prevents destructive metal-to-metal pounding, broken bolts and end plates. The hammer type vibrators are designed to deliver greater impact and will move heavier bulk materials more efficiently. Both models are available in a wide range of sizes and capacities. Standard, easy-to-use mounting plate or special mounts are fabricated on request.

VIBRON Noiseless Muffler Type Vibrator —easily moves bulk materials in small sheet metal bins, hoppers, chutes, screens and sieves. Its supercharging design eliminates destructive, nerve-shattering pounding. The muffler makes the vibrators ideal for use in close proximity to personnel or where noise level is a problem. Vibrators are supplied with standard tang mountings, or special mountings can be fabricated on request.

VIBRON Bantam Lightweight Refractory Gun — eliminates expensive time-consuming hand lining of confined and hard-to-work areas in small ladles, cupolas, runners, furnaces, etc. Refractory patches or linings with 40 to 50% less moisture and greater density are quickly applied. Lining shrinkage, drying time is reduced, operating life of equipment is increased. It weighs only five pounds, operates at greatest efficiency between 85 to 130 P. S. I. air line pressure and comes equipped with a 10-ft. flexible air hose and quick-connect swivel coupling.

ATTRACTIVE TERRITORIES ARE STILL AVAILABLE TO DISTRIBUTORS. YOUR INQUIRIES ARE INVITED. See our complete line of foundry equipment in Booth 1625.

Write for complete details. Ask for Bulletin AF-54.

VIBRON DIVISION OF BURGESS-STERBENTZ CORPORATION

3790 WEST 150TH ST. • CLEVELAND 11, OHIO

CASTINGS GLITTER LIKE

WITH

ASBURY

Diamond Blacking

An all purpose Core and Mold Wash for Sand Castings, Permanent Molds and Ingots

FOR QUALITY PRODUCTS

THE ASBURY GRAPHITE MILLS, INC.

ASBURY NEW JERSEY

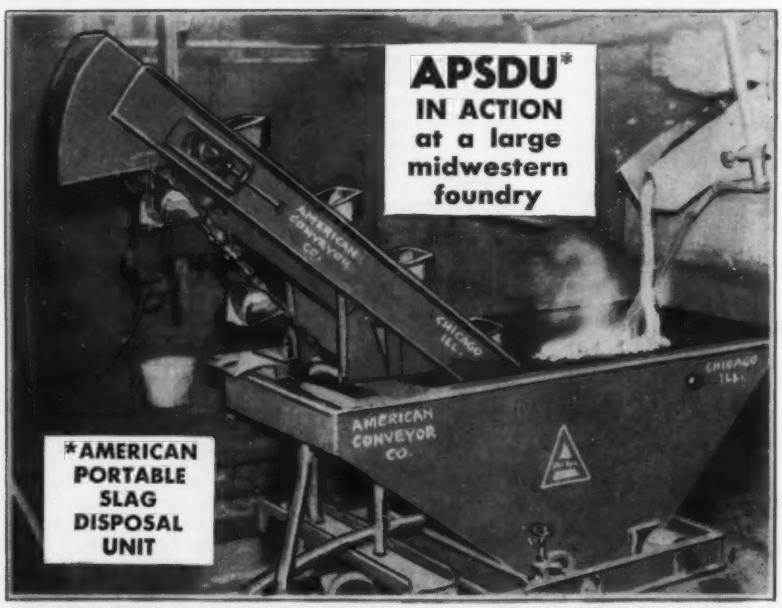
CHICAGO SAN FRANCISCO NEW YORK BOSTON

●

SPECIALISTS FOR

Foundry Facings, Core Washes, Plumbagos, Mold Washes, Shake-on Facings, Head Compounds, Pipe Eliminators, Carbon Raisers

IMPORTERS, REFINERS AND GRINDERS OF GRAPHITE OF ALL TYPES FROM ALL OVER THE WORLD



Water circulating quench tank transforms hot slag to cool granulated slag. Bucket line removes slag to cart, truck or to an American Conveyor.

- Eliminate expensive waterpits
- Eliminate troublesome recirculating pumps
- Eliminate dangerous handling of hot slag
- Eliminate foundry's most undesirable task
- Eliminate hours of manpower
- Low cost
- Pre-engineered
- Packaged unit
- Compact and rugged
- Alternate between cupolas

SEE US IN BOOTH 1509, FOUNDRY SHOW, MAY 8-14, CLEVELAND, OHIO

Phone or write for details on this important equipment!

AMERICAN CONVEYOR CO., 1117 W. ADAMS ST., CHICAGO 7, ILL.

Abstracts

continued from page 229

mined dilatometrically. Data are explained in terms of a hypothesis for mechanism of graphite growth.

A441 .. "Determination of Tin," Methods of Analysis Committee, British Iron & Steel Research Association. *Journal of the Iron & Steel Institute*, vol. 176, no. 2, February 1954, pp. 156-157.

Tin can be determined in iron, and carbon and low-alloy steels without sulphide separation by the method described. Copper and phosphorus do not interfere.

A442 .. "Some Factors Affecting the Wear of Graphite Electrodes in the Electric Arc Furnace," Electric Process Sub-Committee, Steelmaking Div., British Iron & Steel Research Association. *Journal of the Iron & Steel Institute*, vol. 176, no. 2, February 1954, pp. 159-165.

Abnormally high wear of electrode collars is usually associated with high electrical resistivity which is probably due to incomplete graphitization of the material. Simple, non-destructive resistivity tests are described.

A443 .. "Where Pearlitic Malleable Irons Can Be Used to Advantage," Carl F. Joseph. *Materials & Methods*, vol. 39, no. 3, March 1954, pp. 100-103.

Properties of three pearlitic malleable irons are given along with illustrations of their application and explanation of why pearlitic malleable was chosen for the part.

A444 .. "All-Electric Operation Features Modern Permanent Magnet Foundry," Robert H. Herrmann. *Foundry*, vol. 82, no. 1, January 1954, pp. 86-91, 206, 208, 210, 212.

Description and illustrations of new plant for casting and finishing permanent magnets. Includes floor layout.

A445 .. "Sand Castings Can Be Made to Close Tolerances," Lewis B. Reed. *Foundry*, vol. 82, no. 1, January 1954, pp. 92-97, 235-236.

How West Coast foundry produces aluminum and magnesium aircraft castings in sand molds to tolerances as small as plus or minus 0.002 in. and thicknesses as small as 0.1 in.

A446 .. "Several Factors Influence Linear Shrinkage," Hubert Chappie. *Foundry*, vol 82, no. 1, January 1954, pp. 100-103.

Shrinkage allowances for castings vary with the size, design, and method of production. The author illustrates this for large steel castings.

A447 .. "Modern Swiss Foundry Incorporates Automatic Controls," Victor Frey. *Foundry*, vol. 82, no. 1, January 1954, pp. 104-109.

continued on page 231

BIN Stuck Lately?

No matter what your materials handling problem, there's a size and type CLEVELAND vibrator — air or electric — to fit your need.

TYPE F TYPE VG TYPE SA

Write us today for more data on the subject.

2786 Clinton Avenue • Cleveland 13, Ohio

Cut planing costs of patterns with this

"OLIVER" Surfacer

This precision built "Oliver" planes stock up to 24" wide, 8" thick. It feeds at any rate from 18' to 40' a minute at the turn of a dial. Controls centrally located for operator's convenience. Revolving parts enclosed for safety and exclusion of dirt. Has built-in knife jointing and grinding rig. Write for Bulletin 299.

Don't Miss

our display of the latest developments in pattern shop equipment at the AFS Convention

OLIVER MACHINERY COMPANY

Established 1890 GRAND RAPIDS 2, MICH.

Abstracts

continued from page 230

Layout, production method, and controls used in large Swiss foundry producing castings in gray iron, nodular iron, and non-ferrous metals.

A448 .. "Quantity Production of Engineering Castings," J. Burrell. ***Foundry Trade Journal*****, vol. 96, no. 1954, February 11, 1954, pp. 149-155, vol. 96, no. 1955, February 18, 1954, pp. 183-190.**

Layout and equipment, planning, and production methods used in making castings for agricultural and road-making machinery.

A449 .. "Fork-Lift Truck System Speeds Wheel Production," L. W. Bennett and S. Davis. ***American Foundryman*****, vol. 25, no. 2, February 1954, pp. 36-39.**

Simplified materials handling at lower cost results from adoption of power trucking in railroad wheel plant. Includes plant layout, shows truck routes.

A450 .. "Cast Metal Patterns in Shell Molds," Clarence R. Dutton. ***American Foundryman*****, vol. 25, no. 2, February 1954, pp. 40-41.**

How pattern costs were reduced 30 per cent through casting production patterns in shell molds to minimize hand finishing.

A451 .. "Foundry Prepares Own Refractory for Lining and Patching Cupolas," Herbert F. Scobie, ***American Foundryman*****, vol. 25, no. 2, February 1954, pp. 46-48.**

How to do it story on preparation and use of refractory mix (mica schist and fireclay) developed by foundry.

A452 .. "Effect of Prebaking in Malleablizing Iron," Floyd Brown. ***American Foundryman*****, vol. 25. no. 2, February 1954, pp. 50-51.**

Holding white iron at 400 C for an hour prior to malleablizing markedly increases the number of nodules.

A453 .. "Work Simplification Saves $300,000 in Six Years," W. S. Williams. ***American Foundryman*****, vol. 25, no. 2, February 1954, pp. 54-57.**

Philosophy and application of work simplification program and how it has paid off over a six-year period. Tells how to train employees in work simplification.

A454 .. "How Far Should We Go in Foundry Sand Control," Earl E. Woodliff. ***American Foundryman*****, vol. 25, no. 2, February 1954, pp. 60-65.**

Practical suggestions for control of core and molding sand in gray iron, malleable, steel, and non-ferrous shops.

A455 .. "Practical Maintenance Hints for Reduction of Belt Wear," Fred Matheis. ***American Foundryman*****, vol. 25, no. 2, February 1954, pp. 98, 100.**

Tips on loading rubber conveyor belts to achieve maximum wear.

WRITE FOR BULLETIN

Scientific LEADS the field in—

PRECISION . . . QUALITY AND SERVICE

THE SCIENTIFIC CAST PRODUCTS CORP.

1390 East 40th Street
CLEVELAND 3, OHIO

2520 West Lake Street
CHICAGO 12, ILLINOIS

VISIT US IN BOOTH 1803-1805
AFS FOUNDRY SHOW
MAY 8-14

Do You Know?

This match plate solved a nuisance job . . . SAVED 400%

TAMASTONE

THE PERFECT PATTERN COMPOUND

Write! Learn how Tamastone can save in your plant

Tamms Industries, Inc.

228 N. La Salle St., Chicago 1, Ill.

EMPIRE

"THAT GOOD" FOUNDRY COKE

DEBARDELEBEN COAL CORPORATION

2201 First Ave., North Birmingham 3, Ala.
Phone 3-9135

NOW Standard Ejector Pins For Shell Molding!

ELIMINATE EXPENSIVE "Home-Made" PINS . . . .

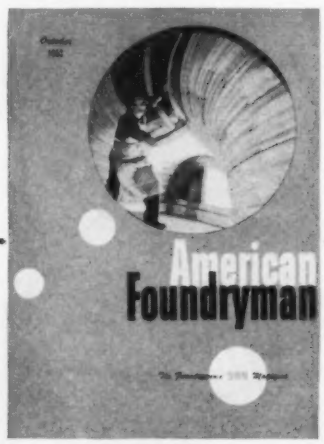
You'll save time and money, because . . . D-M-E Std. Ejector Pins are ready to be installed . . . the "mushroom" head design gives a positive seal that prevents leakage . . . the lengths are held to close limits for uniform ejection . . . steel spring is heat-resistant to prevent loss in tension . . . AND . . . you get IMMEDIATE DELIVERY. . !

Complete assembly (as shown) includes ⅜" Dia. Ejector Pin, Steel Spring, Washers and Cotter Pin, Std. 6" Length, Ea. **50c**
Std. 7½" Length, Ea. **60c**

Call, write or wire for Complete Data . . . TODAY!

DME **Detroit Mold Engineering Co.**

TWinbrook 1-1300 6686 E. McNichols Rd. Detroit 12, Michigan



JUNE
Offical Post Convention Issue of AMERICAN FOUNDRYMAN
To carry Official Reports on events occurring at the 1954 AFS FOUNDRY CONGRESS AND FOUNDRY SHOW May 8-14

MICHIGAN Representative

FOR THE LEADING PRODUCERS OF CRUDE OR DRIED

Natural Molding Sands
Lake Michigan Core Sands
Bank Sands
Silica Sands
Screened Silica Sands
Special Shell Sands
Bentonite
Fire Clays
Fire Brick and Block
Special Brick
Limestone

WARNER R. THOMPSON CO.

2055 W. Grand Blvd.
Detroit 8, Michigan
TYler 8-5362

TICKET TO BOOBY HATCH

Oh, the coremakers and molders with their sore and aching shoulders
Suffer quite a multitude of bruises, bumps and cuts.
But it ain't the jolts and shocks of clamping up a box,
Or the pounding of the rain, or the waiting for the crane.
The shaking of the floor, or the roar, ro:r, ROAR,
It's the rammin', rammin', RAMMIN', drives you nuts.

Any guy who makes his dough pounding sand will let you know
That he's got a job that takes a lot of fortitude and guts.
It isn't just the placing of the sticky, stubborn facing
Or the shoveling of the backing, although they'll admit it's racking;
Or it ain't the constant yammer of the hammer, hammer, HAMMER,
It's the rammin', rammin', RAMMIN', drives you nuts.

To eliminate confusion, I've arrived at this conclusion,
It's certain and it's positive—there are no "ands" or "buts":
No foundry's ever pretty, always noisy, dusty, dirty.
But you wouldn't give a damn if you didn't have to ram;
In a shop of any class, be it iron, steel, or brass,
It's the rammin', rammin', RAMMIN', drives you nuts.

When with sure and steady hand you tamp a pattern in the sand,
And the rammer jumps and curlicues and whistles blows, and putts;
How they jerk and jolt and cough! Almost make your arm fall off;
How you yell and cuss and frown when you knock a gager down!

When you're drawing room and board in some psychopathic ward,
'Twas the rammin', rammin', RAMMIN', DROVE YOU NUTS!

From Rammed Up and Poured, book of foundry poems by Bill Walkins, obtainable from the copyright owners: Electric Steel Foundry Co., 2141 North West 25th Ave., Portland 10, Oregon. Price, $1.85.

CLASSIFIED ADVERTISING

Not available for general advertising; payable with order.

UNDISPLAYED . . For Sale, Help Wanted, Personals, Engineering Service, etc., set solid . . 20c per word, 30 words ($6.00) minimum.
Positions Wanted . . 10c per word, 30 words ($3.00) minimum.
Box number address, care of publisher, should be counted as 10 additional words.

DISPLAYED . . Based on per-column width, per inch . . 1-time, $15.00; 3-time, $13.50 per insertion; 6-time, $12.50 per insertion; 12-time, $12.00 per insertion.

HELP WANTED

PROJECT ENGINEER—for small gray iron foundry middle west. Various non-repetitive production problems including research and development under supervision of Vice-President. Recent graduate foundry option industrial Engineer with some shop experience. Replies confidential. Write full details personal background, résumé of experience, references and salary expected. Address: **Box B26, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago 5, Ill.**

SALESMAN—for Muskegon, Kalamazoo, Grand Rapids territory. Facings, core binders. Must be acquainted with foundry and coreroom requirements. **Box B28, AMERICAN FOUNDRYMAN, 616 South Michigan Ave., Chicago 5, Ill.**

FOUNDRY FOREMAN. To supervise operations of a Jobbing Foundry located in Edmonton, Alberta, Canada. Production is chiefly light to medium weight gray iron; also some Ni-Hard; alloy iron and non-ferrous castings. Daily melt 8 to 10 tons. Sound knowledge required of cupola, mechanical molding, coke room and cleaning operations. Give full details of personal background, experience and salary expected. **Reply Box B21, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago 5, Ill.**

SUPERINTENDENT. Well established malleable foundry offers excellent opportunity for qualified superintendent. Knowledge of mechanized operations desired. State age, experience and salary desired. **Box B27, AMERICAN FOUNDRYMAN, 616 S. Michigan Ave., Chicago 5, Ill.**

SALESMAN—To sell cereal core binders to the foundry industry. Must be experienced core or sand technician. Permanent, salaried position with large manufacturer. If you have the necessary experience and believe you can produce write **Box B25, AMERICAN FOUNDRYMAN, 616 South Michigan Ave., Chicago 5, Ill.**

FOUNDRIES FOR SALE

6700 square foot foundry including complete sand laboratory, fireproof pattern vault, storage sheds, excellent equipment for all sand cast metals. Building and wheelabrator partially damaged by fire. Have good customers but destruction of machine shop by fire forces immediate sale. Address:
Wilbur C. Rice, Greenwich, N. Y.
Phone: Salem, New York 3528

FOR SALE

FURNACES FOR SALE
10 used Heat Treating Furnaces, and two 7-ton gantry cranes, good condition, priced to sell.
BAER STEEL PRODUCTS, INC.
Box 1428
Boise, Idaho

WANTED-TO-BUY

Wanted to Buy for Cash. Transactions, A.F.S. and other technical periodicals. **Ashley-Ratcliff Corp., 24 E. 21st St., New York, N.Y.**

ENGINEERING SERVICE

Management Engineers and Consultants.
Trouble Shooting—Technical & Cost
CARL E. ROWE & COMPANY
500 W. National Ave. Milwaukee 4, Wis.
Evergreen 4-2733

EARL E. WOODLIFF,
Foundry Sand Engineer.
Consulting . . . Testing.
14611 Fenkell (5-Mile Rd.) Detroit 27, Mich.
Res. Phone Vermont 5-8724

A.F.S.

Membership

. . . AN INVESTMENT IN PROGRESS

"The man who does not keep closely in touch with his competitors in these days is likely to find himself far behind in the race. No man has a monopoly of the good ideas in any branch of industry, and there is no man who is so well informed, so thoroughly conversant with the details of his own business, that he can learn nothing by discussions with his fellow manufacturers. Those who know the most, those who are most progressive in their business, are most willing to acquire new ideas which will place them still further in the lead."

These thoughts formed the keynote of the A.F.S. Inaugural Meeting, in 1896 . . . today, in this era of keen competition, the wisdom is equally sound.

Membership in the American Foundrymen's Society continues to present unusual opportunities for making new friends throughout the foundry industry . . . through Committee service, Chapter meetings, and the annual Foundry Congress . . . friends with whom you can discuss a solution to common foundry problems.

AMERICAN FOUNDRYMEN'S SOCIETY
616 South Michigan Ave., Chicago 5, Illinois

USED

FOUNDRY EQUIPMENT

FOR SALE

You will find we have hundreds of good, used foundry machines ... ALL GUARANTEED ...

As an example ...

NOW ... we have for sale one fully equipped mechanized gray iron foundry, new in 1949, in operation for only ONE YEAR.

The COCKSHUTT FARM EQUIPMENT, Inc.
Bellevue, Ohio

- Overhead sand handling system.
- 2 No. 3 Simpson mixers in sand system.
- 30 molding stations.
- Automatic shakeouts.
- Tower core oven.
- 5 Ton Gantry crane for charging cupolas and unloading freight cars

SEE OUR BOOTH

While at the FOUNDRYMAN'S SHOW in Cleveland, May 8 — 14, 1954, *stop at our booth* NUMBER 1716 for our latest listings and free transportation to our display rooms and warehouse.

GUARANTEE

Our guarantee is if you are not satisfied with our equipment, you may return it for a *full refund.*

EUCLID FOUNDRY & MACHINE EQUIPMENT COMPANY

"We buy and sell one piece of equipment — or complete foundries"

14919 Saranac Road, GLenville 1-1222

CLEVELAND 10, OHIO

Index to Advertisers

199	Accurate Match Plate Co.
235	Acme Equipment Co., Inc.
186	Acme Resin Corp.
16	Adams Co.
21	Ajax Electrothermic Corp.
19	Ajax Flexible Coupling Co., Inc.
11	Allis-Chalmers Mfg. Co.
190-191	American Air Filter Co., Inc.
230	American Conveyor Co.
28	American Lava Corp.
8	American Monorail Co.
197	American Refractories and Crucible Co.
10	American Wheelabrator & Equipment Corp.
Inside Back Cover	Archer-Daniels-Midland Co. (Foundry Products Div.)
230	Asbury Graphite Mills, Inc.
9	Baker Perkins, Inc.
26	Baroid Sales Div., National Lead Co.
41	Barrett Division, Allied Chemical & Dye Corp.
35-36-37-38	Beardsley & Piper, Div. Pettibone Mulliken Corp.
34	Black, Sivalls & Bryson, Inc.
219	Buckeye Products Co.
229	Burgess-Sterbentz Corp., Vibron Division
223	Campbell-Hausfeld Co.
49	Carborundum Co., The
227	Chicago Spectro Service Laboratory, Inc.
30-31	Cleveland Flux Co.
231	Cleveland Vibrator Co.
66	Crucible Manufacturers Assn.
175	Davenport Machine & Foundry Co.
232	De Bardeleben Coal Corp.
182-183	Delta Oil Products Co.
29	Demmler, Wm., & Bros.
232	Detroit Mold Engineering Co.
62	Dow Corning Corp.
48	Dravo Corp.
53	Eastern Clay Products Dept.
151	Eastman Kodak Co.
166	Electro Metallurgical Co., A Division of Union Carbide & Carbon Corp.
234	Euclid Foundry & Machine Equipment Co.
6	Fanner Mfg. Co.
1	Federal Foundry Supply Co.
32-33	Foundry Equipment Co.
60	Fremont Flask Co.
165	Giffels & Vallet
52	Grindle Corp.
204	Hardy Sand Co.
61	Harris, Benj., & Co.
198	Hercules Powder Co.
4-5	Herman Pneumatic Machine Co.
202	Homer Mfg. Co., Inc.
185	Houghton, E. F., & Co.
220	Hydroway Scales, Inc.
7	Industrial Crane & Hoist Corp.
228	Industrial Silica Corp.
203	International Molding Machine Co.
40	International Nickel Co.
228	Jarrell-Ash Co.
224	Kindt-Collins Co.
167	Knight, Lester B., & Assoc., Inc.
171	Kramer, H., & Co.
170	Lanly Co.
64	Lavin, R., & Sons, Inc.
22-23	Lindberg Engineering Co., Fisher Furnace Div.
39	Link-Belt Co.
226	Magie Bros., Inc.
221	Martin Engineering Co.
2	Modern Equipment Co.
174	Molybdenum Corp. of America
12-13	Monsanto Chemical Co.
189	National Carbon Co., A Division of Union Carbide & Carbon Corp.
194-195	National Engineering Co.
172	Newaygo Engineering Co.
227	Nugent Sand Co.
63	Ohio Ferro-Alloys Corp.
231	Oliver Machinery Co.
45	Pangborn Corp., Blast Cleaning Div.

Index to Advertisers

14	Pangborn Corp., Malleabrasive Div.
201	Peninsular Grinding Wheel Co.
222	Pennsylvania Foundry Supply & Sand Co.
42-43	Pennsylvania Glass Sand Corp.
42-43	Pennsylvania Pulverizing Co.
47	Penola Oil Co.
Inside Front Cover	Pittsburgh Lectromelt Furnace Corp.
196	Porcelain Products, Inc.
15	Reichhold Chemicals, Inc.
65	Royer Foundry & Machine Co.
20	Schneible, Claude B., Co.
231	Scientific Cast Products Corp.
50-51	Semet-Solvay Div., Allied Chemical & Dye Corp.
225	Severance Tool Industries, Inc.
168	Si Pi Metals Corp.
173	Standard Electrical Tool Co.
27	Standard Horse Nail Corp.
17-18	Sterling Wheelbarrow Co.
46	Stevens, Frederic B., Inc.
225	Superior Pneumatic & Mfg. Co.
55-56-57-58	Sutter Products Co.
226	Syntron Co.
231	Tamms Industries
232	Thompson, Warner R., Co.
	Union Carbide & Carbon Corp.
166	Electro Metallurgical Co.
189	National Carbon Co.
193	Universal Engineering Co.
24-25	Vanadium Corp. of America
229	Vibron Division, Burgess-Sterbentz Corp.
169	Westover Engineers
Back Cover	Whiting Corp.

Instrument Society of America Publishes 1953 Proceedings

THE 1953 Proceedings of the Instrument Society of America has just come off the press and contains all 74 technical papers presented before the national conference of the group in Chicago, September 21-25, 1953.

Included in the volume are papers on such subjects as instrumentation for production processes, testing instrumentation, instrument operation and maintenance, physical properties measurement, aeronautical instrumentation, instrumentation for transportation, medical instrumentation, geophysical instrumentation, and process control instrumentation.

Valuable Reference Material

More than 300 pages of the publication are devoted entirely to measurement and control. The material will be valuable as reference for college engineering departments, technical libraries, consulting firms, and other such organizations.

Should Order Early

Copies of the Proceedings may be ordered by mail, both by ISA members or non-members. Orders for the volume should be sent to the society at 1319 Allegheny Ave., Pittsburgh 33, Pa. Since the book is off-press, orders should be completed within a relatively short period.

STOP AND SEE US ON YOUR WAY TO OR FROM THE CONVENTION

FOR SALE

ELECTRIC MELTING FURNACES

Electromelt Type C Side Charge, 2 ton per hour rated capacity. 7000# to 8000# usual heats. Can handle 16,000# heats. Late type transformers. 1200 KVA, 13,200 volt primary. Complete with all controls.
Detroit Electric, 1500# capacity, 13,200 primary voltage. Kuhlman transformers. Complete with controls.
Detroit Electric 350#, Type LFA with Kuhlman transformers and oil circuit breaker.
Lectromelt 500# Type T, Side Charge, G. E. Circuit breaker. Moore controls and Pittsburgh 300-375 KVA 2300 volt primary transformer.
Detroit Electric with 350# and 100# tapered shells, 2300 V Kuhlman Transformer. Complete with panelboard and bus bars.
2—Detroit 10# Electric Laboratory size melting furnaces, 100 amp, 250 volt.

MOLDING MACHINES

2—Champion Pin Lift Pushoffs, 46" x 46" x 12" draw.
1—Champion Hand ram, hand clamp, hand rollovers 26" x 14" table.
1—Champion Hand ram, hand rollover, hand draw core, 15 x 15 bed.
3—Davenport Portable Jolt Rollover Pattern Draw 20" x 24" tables, open end. 8" draw.
1—International Type G, 24 x 10 Jolt Rollover, foot draw, 22 x 30 table, 10" draw.
1—Herman Molding Machine Jolt Rollover Pattern Draw, 20 x 30.
1—Herman Molding Machine Jolt Rollover Pattern Draw, 20 x 36.
1—International Type G 30 x 12 Jolt Rollover Foot Draw, 28" x 36" table, 12" draw.
1—International Type G 30" x 30" table, 9" draw. Portable.
2—International Type G 18" x 56" table, 8" draw. Portable.
1—International Type F Jolt Rollover 27 x 12, 12" draw, 35" x 26" table.
1—International Jolt Rollover Pattern 10" draw, 22" x 30" plate, 6" jolt cylinder.
1—International Plain Jolt Molding Machine 48" x 60" table, no pit required.
1—Herman Jolt Rollover Pattern draw, 40" x 84" table, slotted nickel alloy table over regular table to accommodate various sized flasks, air clamp. New 1946. Used very little.
1—Herman 20" x 30" rollover pattern draw, 750# series. Air clamp.
2—Herman 20" x 24" Jolt Rollover Pattern Draw, 750# series. Air Clamp.
1—Herman 4000# Series High Speed Rollover 30" x 60" with 32" x 48" bumper. 13" cylinder pattern device.
2—Milwaukee Arm Type Jolt Squeeze Strippers, 1500# capacity, Model 163-50, Serials 13104-5, 15" x 24" table, 16" x open end, pattern size. Late type.
1—Osborn 76J Portable Jolt Squeeze Molding Machine, 12" cylinder.
3—Osborn Jolt Squeeze Molding Machine, 275J, 16" x 20" table, tilt back head.
2—Osborn 405 Jolt Rollover 40" x 70", 2000# capacity, 20" x 60" jolt table and 4 wheel receiving car.
1—Osborn Portable Jolt Rollover Pattern Draw, 900# capacity. Model 601-13. 30" x 24" flask size, 10" draw.
1—Tabor 1000# Rollover, 30" x 60" table.

MULLERS AND MIXERS

Simpson #2 Motor on base, bucket loader.
Simpson #3 Motor on base, bucket loader.
Simpson #3 Type H open gear type.
Simpson #3 Open Gear Type.
American Model M Sand Cutter, 70" blades.
Kwick Mix Paddle Type.
Royer NDP 47 14" belt, 4 rubber tires.
Simpson #1 Style K Muller with bucket loader, 4 cu. ft. size.

We will buy for cash a single piece of equipment or your entire foundry.

ACME EQUIPMENT CO., INC.

128 SOUTH CLINTON STREET
CHICAGO 6, ILLINOIS
ANdover 3-3430

A.F.S. Publications

Publication Number		A.F.S. Members	Non-Members
FERROUS FOUNDRY PRACTICE			
1	Alloy Cast Irons Handbook	$2.75	$4.50
64	American Malleable Iron Handbook (MFS)	4.00	4.00
46	Engineering Properties of Cast Iron	2.25	3.50
11	Ferrous Foundry Process Control (SAE)	1.50	2.50
65	Recommended Names for Gates and Risers (Booklet)	.25	.40
47	Sand Test Data for Production of Steel Castings	3.00	4.75
	Charts		
44	Graphite Classification Chart (25x38 in.)	1.25	1.75
66	Recommended Names for Gates and Risers (17x28 in.)	.25	.40
	Research Reports		
49	Cupola Research Committee Reports	1.00	1.50
42	Risering of Gray Iron Castings—Report No. 1	1.00	2.00
43	Risering of Gray Iron Castings—Report No. 2	1.00	2.00
73	Risering of Gray Iron Castings—Report No. 4	.35	.55
53	Steel Sands at Elevated Temperatures (Tenth)	.40	.60
76	Steel Sands at Elevated Temperatures (Twelfth)	.40	.60
NON-FERROUS FOUNDRY PRACTICE			
2	Aluminum Foundry Process Control (SAE)	1.00	2.50
68	Cast Bronze (ASM)	5.00	5.00
57	Copper-Base Alloys Foundry Practice	3.75	5.75
24	Recommended Practices for Sand Casting Aluminum & Magnesium Alloys	1.00	1.75
	Research Reports		
54	A Study of the Principles of Gating	1.00	1.50
55	Melt Quality & Fracture Characteristics of 85-5-5-5	1.00	1.50
58	Principles of Gating as Applied to Sprue-Base Design	.50	.75
77	The Study of Vertical Gating	.50	.75
GENERAL FOUNDRY INTEREST			
3	Analysis of Casting Defects	2.50	4.25
35	Bibliography of Centrifugal Casting	1.50	2.25
8	Development of Metal Castings Industry	3.00	6.00
38	Foundry Core Practice	6.50	10.00
12	Foundry Sand Handbook	3.50	5.25
40	Gates and Risers for Castings (Penton)	6.00	6.00
67	Glossary of Foundry Terms	.75	1.25
18	Permanent Mold Castings Bibliography	1.50	3.00
65	Recommended Names for Gates & Risers (Booklet)	.25	.40
63	Statistical Quality Control for Foundries	4.50	6.75
56	Symposium on Principles of Gating	4.00	5.75
71	Symposium on Sand Reclamation	1.50	2.25
	Patternmaking		
61	Patternmaker's Manual	4.50	6.75
51	Pattern Standard Color Chart	.10	.25
	Safety, Hygiene, Air Pollution Control		
19	Fundamentals of Design, Construction and Maintenance of Exhaust Systems	3.00	5.00
20	Good Practices for Metal Cleaning Sanitation	1.25	2.25
22	Grinding, Polishing and Buffing Equipment Sanitation	.75	.75
59	Health Protection in Foundry Practice	3.00	4.50
75	Lighting for Foundries	.50	.50
21	Safety Practice for Protection of Workers in Foundries	1.25	2.25
62	Symposium on Air Pollution	1.75	2.50
10	Symposium on Foundry Dust Control	1.00	2.00
69	Symposium on Foundry Safety, Health and Air Pollution	3.00	5.00
	Training and Education		
29	Apprentice Training Standards for the Foundry Industry	1.00	2.00
39	Foundry Apprentice Training Course Outline	1.00	2.00
50	Foundry Work	1.76	1.76
34	Guide for Foreman Training Conference	1.50	2.25
	Foundry Costs		
78	Basic Cost Systems for Foundries—No. 1 (GIFS)	5.00	5.00
6	Classification of Foundry Cost Factors	1.00	2.00
	Transactions		
30	Volume 53—1945	4.00	15.00
31	Volume 54—1946	4.00	15.00
33	Volume 57—1949	8.00	15.00
72	Volume 61—1953	8.00	15.00
70	Index to AFS Transactions (1941-1950)	2.75	4.25

AMERICAN FOUNDRYMEN'S SOCIETY
616 South Michigan Avenue, Chicago 5, Illinois
Please send the books circled above. $..... remittance enclosed.

Name _____

Address _____

City _____ Zone _____ State _____

Company _____

AFS pays postage when remittance accompanies order (USA only)

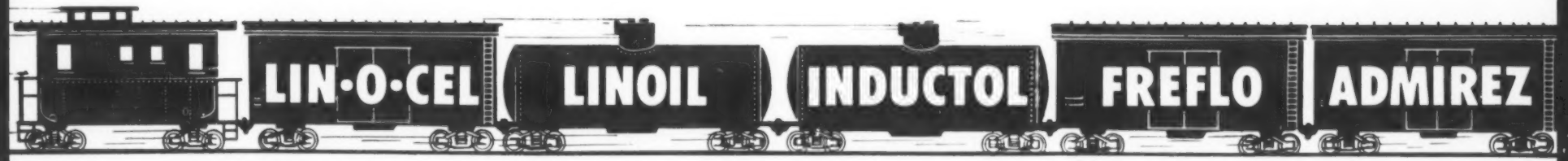
PLEASE CIRCLE PUBLICATION NUMBER OF BOOK DESIRED

the fastest-moving line in the Foundry Field...

Improved foundry methods demand a constant flow of modified oils and binders, as well as entirely new products for core making and molding. The need today is for greater efficiency at lower cost.

ADM keeps pace with the foundry industry by anticipating its needs through never-ending research. Proof lies in the fact that more than half the core binders consumed in American foundries are made by ADM. Furthermore, foundrymen know they can rely on ADM for absolute uniformity . . . and service second to none.

on its way to you . . . . from ONE SOURCE!



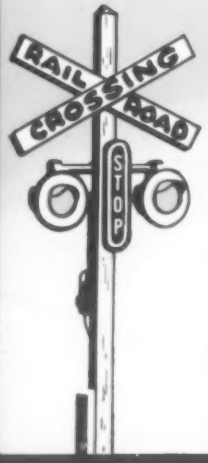
Archer **LIN•O•CEL** is the most effective sand stabilizer available. It improves flowability, which in turn, produces better tolerance and definition. Because LIN-O-CEL compensates for sand expansion, it stops rat-tails, buckles, and scabs which normally might occur due to denser rams made possible by improved flowability.

LINOIL, the most-used core oil in America, produces stronger cores at less cost. You can find among the seven grades of "700 LINOILS", for instance, an oil practically tailor-made to your core requirements. Whatever the grade selected, you can depend upon uniformity from shipment to shipment.

INDUCTOL, the new pre-baked core oil, bakes in half the time required for conventional oils. It bakes over a wide temperature range and resists over-baking so that large and small cores can be successfully baked at the same time. INDUCTOL produces considerably less gas than most core oils.

FREFLO is used two ways: (1) As a core sand conditioning agent to reduce stickiness and improve workability. (¼ of 1% by weight should be added during the final 30 seconds of mixing.) (2) As a parting compound for metal molding patterns. FREFLO is a great aid in modern, high-speed equipment.

The most recent addition to the ADM line is **ADMIREZ** resin binders. Available in urea and phenol formaldehyde types in both liquid and powdered forms for cores. Phenol type also available in powdered form for "C" (or shell molding) process.



STOP!

Whether or not you are using ADM foundry products, it pays periodically to check your core mixture. Proper use of any material will save you production dollars. Your LINOIL man can assist you in analyzing your specific core problems. He is backed by fully equipped laboratories, experienced ADM chemists, and foundry technicians who will analyze your problems upon request.

WHEREVER YOUR FOUNDRY IS LOCATED, there is an ADM office close by. Contact the one in your locality for full details on the fastest-moving line in the foundry field. Addresses are listed here.

COLORADO
Denver 2,
1732 Blake Street

ILLINOIS
Chicago 22,
927 Blackhawk St.
Rock Island
3847 28th Avenue

INDIANA
Indianapolis 4,
18 S. New Jersey St.

KANSAS
Kansas City 2,
1721 Minnesota Ave.

MASSACHUSETTS
Boston 9,
141 Milk Street

MICHIGAN
Detroit 35,
18911 James
Couzens Highway

MINNESOTA
Minneapolis 2,
600 Roanoke Bldg.

MISSOURI
St. Louis 19,
No. 2 Armin

NEW YORK
Buffalo 3,
1524 Marine Trust
Building
New York 7,
9th Floor, Woolworth
Building

OHIO
Columbus 15,
1935 LeVeque
Lincoln Tower
Toledo 5,
1152 East Broadway

PENNSYLVANIA
Lancaster
P. O. Box 1412
Philadelphia 18,
18 Hilltop Road

WISCONSIN
Milwaukee 16,
3003 W. Hopkins St.

CANADA
Montreal 1,
1215 Greene Avenue
Toronto 10,
200 Fairbank Ave.
Vancouver
2845 Grandview Hy.

EXPORT
New York 7,
9th Floor, Woolworth
Building

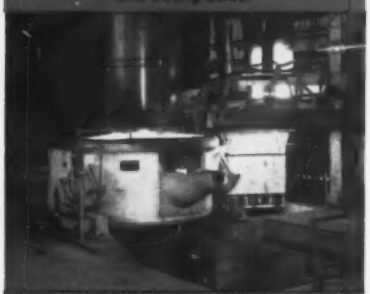
ARCHER · DANIELS · MIDLAND COMPANY
FOUNDRY PRODUCTS DIVISION • 2191 WEST 110TH STREET • CLEVELAND 2, OHIO

WHITING

Hydro-Arc

ELECTRIC FURNACES

Hydro-Arc furnace with roof lifted and swung aside.



An "orange-peel" drop bottom bucket fills furnace with one drop.

"Business End" of HYDRO-ARC Furnace. Servo Units used to raise or lower electrode arm.

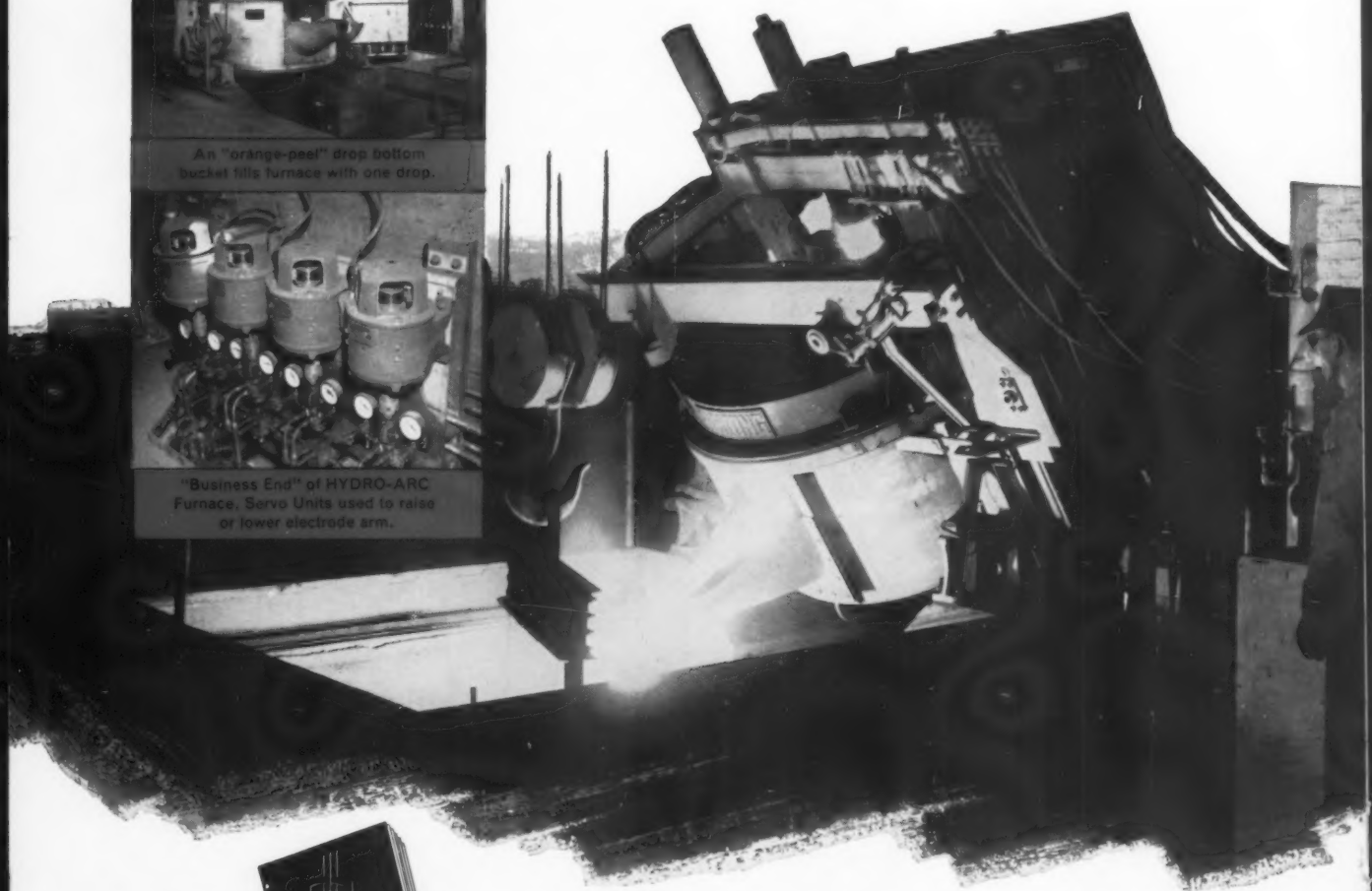
HERE'S THE "Pace-Setter" IN ELECTRIC MELTING!

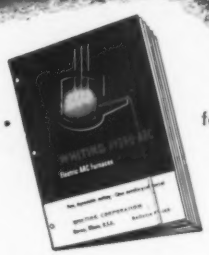
You ask, "What electric furnace offers the most advantages?" The answer is WHITING HYDRO-ARC because of its important, advanced engineering principles! To name a few:

1. **The Hydro-Arc Automatic Electric Clamp,** pioneered by Whiting, saves up to 90% of furnace down-time for slipping electrodes. It also means an 8% increase in operating time and production . . . and in addition, the elimination of the hazardous electrode slipping operation.

2. **The Unique Hydro-Arc Top Charge,** a load factor improvement, reduces furnace down-time for recharging to only a few minutes. Because of its sound, basic simplicity, limit switches are eliminated and maintenance is held to a minimum.

3. **The Hydro-Arc Air-Counterbalanced Hydraulic Electrode Positioning Equipment** assures less electrical energy and electrode consumption as well as improved metallurgical control and longer refractory life.





Write today . . . for 40 page bulletin FY-168. It completely describes Whiting Hydro-Arc Electric Arc Furnaces!

WHITING CORPORATION
15628 Lathrop Avenue, Harvey, Illinois